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CONTENTS

PAGE

No. 1.—On the Blood Vascular Bundles in the Limbs of Certain Edentates and Lemurs. By George B. Wislocki and William L. Straus, Jr. (4 plates). April, 1932 1

No. 2.—A Study of the Osteology of Alligator Prenasalis (Loomis). By Charles C. Mook. (3 plates). July, 1932 . 17

No. 3.—On Certain Similarities between Sloths and Slow Lemurs. By William L. Straus, Jr. and George B. Wislocki. September, 1932 43

No. 4.—Fossil Types of Fishes, Amphibians, Reptiles and Birds in the Museum of Comparative Zoölogy. By W. E. Schevill. December, 1932 57

No. 5.—Birds from Northwest Yunnan. By James C. Greenway, Jr. February, 1933 107

No. 6.—New and Little Known Spiders from the United States. By Elizabeth B. Bryant. (4 plates). June, 1933 . . . 169

No. 7.—Reports on the Scientific Results of an Expedition to the Southwestern Highlands of Tanganyika Territory. VII. Herpetology. By Arthur Loveridge. (3 plates). October, 1933. 195

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ON THE BLOOD VASCULAR BUNDLES IN THE LIMBS OF CERTAIN EDENTATES AND LEMURS

By George B. Wislocki and William L. Straus, Jr.

[From the Departments of Anatomy, Harvard University and Johns Hopkins University]

With Four Plates

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No. 1.— *On the Blood Vascular Bundles in the Limbs of Certain Edentates and Lemurs*

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Introduction

At the beginning of the last century (1800, 1804), Carlisle wrote two short papers on "a peculiarity in the distribution of the arteries sent to the limbs of slow moving animals," in which he described, in the extremities of sloths, as well as of "Lemur tardigradus" and of "Lemur loris," blood vascular plexuses, related, as he believed, to the slow movements executed by these animals. Now, over a century later, great uncertainty still exists as to the significance and even the morphology of the various forms of such plexuses, or *retia mirabilia*, found in various mammals, especially in their extremities.

Weber (1928) is of the opinion that it is inadmissible to correlate the blood vascular plexuses of the extremities of the Bradypodidae with their slow movements, because plexuses are present in such active animals as the Dasypodidae (**2**, p. 27). Concerning the lemurs he says that in the extremities there occur arterial and venous plexuses similar to those seen in the Xenarthra. These plexuses are found in the Lorisinae, which during the day sleep on the branches of the trees, while at night they execute their sluggish movements. It would be hazardous, however, according to Weber (**2**, p. 732), to associate the slow movements of these animals with the plexuses, because Vrolik (1826) has described similar plexuses in Tarsius, a nocturnal animal which is extremely active.

We have had the opportunity of studying both grossly and microscopically the blood vessels of the extremities of a number of specimens of edentates and of lemurs and of Tarsius. Our observations, we believe, help to clarify certain of the problems relating to the *retia mirabilia* in the limbs of mammals.

Material

Of the Xenarthra we have had at our disposal for dissection numerous specimens of *Cholœpus hoffmanni*, the two-toed sloth, and of *Bradypus griseus*, the three-toed sloth; one specimen of *Cyclopes didactylus*,

the two-toed ant-eater; one specimen of *Tamandua tetradactyla*, the four-toed ant-eater; and several specimens of *Dasypus novemcinctus*, the nine-banded armadillo.

Of the Pholidota we have dissected one specimen of *Manis javanica*, the pangolin.

Of the Lemuroidea we have studied a single specimen of *Perodicticus potto*, and two specimens each of *Nycticebus borneanus*, *Lemur variegatus* and *Galago* sp.?

Of the Tarsioidea we have examined single specimens of *Tarsius philippinensis*, *T. fraterculus* and *T. saltator*.

We wish to express our thanks to Mr. Gerrit S. Miller, Jr. of the U. S. National Museum and Dr. Milton J. Greenman of the Wistar Institute for the use of specimens. We are also indebted to the Barro Colorado Island Laboratory, Panama Canal Zone, for the opportunity of studying sloths.

Observations

Our observations have added to the evidence that there are several types of blood vascular plexuses, as reported by Hyrtl and by Müller. Not only have we examined these specimens by gross dissection, but we have also introduced microscopic examination in some instances as a more reliable means of discriminating the types of plexuses.

We have been able to distinguish at least two types of plexiform distribution of blood vessels in the extremities: (1) the vascular bundle, and (2) the simple vascular network. By vascular bundle we mean a type of plexus typically seen in the limbs of sloths. The precise structure of such a plexus consists in a breaking up of the main artery of the extremity into a principal trunk surrounded by upwards of 30 to 40 smaller arteries which are given off from the main stem and accompany it as parallel vessels lying in a common sheath. These vessels are destined, after running in the sheath for variable distances and anastomosing sparsely, to supply the muscles of the extremity. The veins running in the bundle are of about the same number and distribution as the arteries.

The vascular bundle type of plexus occurs in its most pronounced form among the Xenarthra, in the didactyl and tridactyl sloths (*Choloepus* and *Bradypus*) and in the two-toed ant-eater (*Cyclopes*) (figs. 1–4). In these animals the bundle formation involves not only the main vessels of arm and thigh, but the chief trunks of forearm and leg as well.

Among our prosimian material we find the same arrangements in

our examples of the Lorisinae, namely in *Nycticebus* and *Perodicticus*. In both of these we have observed, grossly as well as microscopically, vascular bundles in arm and forearm and thigh and leg; these bundles are almost completely identical with those observed in *Cholœpus*, *Bradypus* and *Cyclopes*. In the brachial bundle of *Perodicticus* (fig. 5), 1 large artery, 47 small ones and 28 veins are counted in a typical cross-section; in the femoral bundle (fig. 6), 2 large arteries, 55 small ones and 39 veins. In *Nycticebus*, in the brachial bundle (fig. 7), 1 large artery, 27 small ones and 22 veins are present; in the femoral bundle (fig. 8), 1 large artery, 59 small ones and 40 veins. The small arteries are all of nearly equal size, as are the veins also. It is observed, moreover, from the microscopic examination, that anastomoses of the veins are more numerous than of the arteries. No single large venous trunk corresponding to a brachial or femoral vein occurs in the bundle. The femoral bundle of *Perodicticus* in the present specimen, as well as both brachial and femoral bundles in *Cyclopes*, contain two, instead of one, main arterial vessels. In the majority of animals possessing bundles, a single main artery appears to be the rule. Whether in the present instances of *Perodicticus* and *Cyclopes* the occurrence of two arteries is a variation from the norm, or whether this is the usual arrangement for these animals, we have no means of ascertaining.

We also find the bundle type of *rete mirabile* occurring in the limbs of *Tamandua* and *Manis*. In these animals, however, the bundles are limited to vessels supplying the forearm and the leg in the respective extremities. The great arteries of the upper arm (brachial) and the thigh (femoral) are not plexiform as in the sloths, *Cyclopes* and lorises, being single vessels (figs. 13, 14, 16, 17). The *retia* of *Tamandua* and *Manis* prove, however, on both gross and microscopic examination, to be true vascular bundles, identical in their structure with those of sloth and loris (figs. 15, 18).

In the other animals examined we found no indications of the bundle type of plexus. *Dasypus* possesses *retia mirabilia* in its extremities, but these are quite dissimilar to the bundles seen in the sloths, lorises, ant-eaters and pangolin. They are at most but simple networks of the nature of a few widely scattered anastomoses.

A rather different arrangement obtains in our specimens of *Tarsius*. Sections through the upper arm show that the brachial artery is a single tube unaccompanied by a blood vascular bundle (fig. 11). The femoral artery, however, instead of being represented by a single vessel, breaks up into a number of branches immediately after emerging from the pelvis onto the thigh (fig. 12). The plexus so formed is, however,

by no means like the vascular bundle encountered, for example, in sloths. It consists, instead, of arteries and veins, all of about equal size, irregularly scattered in small groups throughout the connective tissue without the formation of a common sheath. In a typical cross-section through the region of the upper part of the thigh are counted 24 arteries and 28 veins which are scattered over a considerable area. Thus in the thigh of *Tarsius* we are dealing not with a characteristic vascular bundle, but with a more diffuse type of plexiform distribution.

In specimens of *Galago* and *Lemur variegatus* also, we find, both grossly and microscopically, no close resemblance of the vessels of the extremities to those of sloths, lorises or two-toed ant-eaters. The blood vessels are, in so far as they are plexiform, of the simple network pattern, and nothing comparable to a vascular bundle involving either the upper or lower extremity arteries can be seen. (Figs. 9, 10.)

By the reinvestigations of these several animals we believe that we can safely speak of the blood vascular bundle involving the entire limb (arm and forearm, thigh and leg) as characterizing the sloths, the two-toed ant-eater and the Lorisinae. A less complete form of this vascular bundle, involving only branches to the forearm and thigh, occurs in the four-toed ant-eater and pangolin. Simple plexiform anastomoses occur in both extremities of the armadillos and in the thigh of *Tarsius*. In *Galago* and *Lemur* the main blood vessels of both limbs are in general single tubes.

Discussion

Plexuses of blood vessels in the limbs of mammals have aroused the interest of numerous observers since the time of Carlisle (1800, 1804). Thus we find descriptions of them in the papers of Vrolik (1826), von Baer (1835), Burmeister (1846), Rapp (1852), Hyrtl (1853, 1864), Huxley (1864), Chapman (1874), Zuckerkandl (1895) and Müller (1905). *Retia mirabilia* of variable degrees of complexity are described in representatives of nearly all groups of mammals, for instance in the monotremes, some marsupials, all edentates, some ungulates, hyracoids, certain fissipeds, pinnipeds, some rodents, lemurs, *Tarsius*, and finally in the rudimentary arms of cetaceans.

Both Hyrtl (1853, 1864) and Müller (1905) dissected large comparative series of mammals. Hyrtl divided *retia mirabilia*, as he observed them in the extremities, into two categories: (1) radially diffuse networks, and (2) massive networks. A similar classification was adopted by Müller, who recognized (1) the network, and (2) the radiating fan

or brush. These investigators thus agree that there are two types of *retia mirabilia* in the limbs of mammals. With this our own observations accord most fully. We have preferred to speak of these types of *retia* as (1) the simple vascular network, and (2) the vascular bundle. A third type, a radiating plexus of blood vessels, as encountered in the upper extremities of cetaceans and pinnipeds, deserves perhaps to be set apart from the others, but the anatomical data concerning it do not justify its consideration at the present time.

In spite of the fact that both Hyrtl and Müller define two types of *retia mirabilia* and give illustrations of each, other comparative anatomists have usually ignored their classifications, speaking merely of blood vascular plexuses in the extremities of various mammals without making it clear to which type the animals belong. This leads to confusion, because only by a discrimination of the morphology of the plexuses can we hope eventually to attain some concept of their origins and functions.

From our own investigations and from the more detailed descriptions in the literature, we feel justified in concluding that the simple network type of blood vascular plexus occurs in many mammals of widely separated orders. Among our own material such a form of plexus is encountered in the Dasypodidae and in *Tarsius*. The great ant-eater (*Myrmecophaga jubata*), closely allied to *Tamandua*, likewise possesses a simple network type of vascular plexus in its extremities, but the plexiform branches are more numerous and elaborate than in the Dasypodidae, although, as in them, confined to forearm and leg (Müller). The complete vascular bundle type occurs only in certain of the Xenarthra, namely the sloths and the didactyl ant-eater, and in certain of the Lemuroidea, namely the Lorisinae (*Nycticebus, Loris, Perodicticus, Arctocebus*). The less pronounced type of vascular bundle, confined to arteries and veins of forearm and leg, is limited to the four-toed ant-eater (*Tamandua*) of the Xenarthra, and to the pangolin (*Manis*) of the Pholidota.

Certain species of *Manis*, however, may possibly possess more complete vascular bundles. In *Manis macrura*, Hyrtl describes and pictures what appears to be a true vascular bundle involving the main artery of the upper arm (brachial artery). The artery of the thigh (femoral artery), on the other hand, according to Hyrtl, is not plexiform, *retia mirabilia* occurring only in certain branches in the leg. In the upper extremity of *Manis lauticaudata,* contrary to the observation of Hyrtl, Müller states that plexuses appear only as one approaches the distal portion of the upper arm, involving typically the

median and the radial arteries. In our experience, with a specimen of *Manis javanica*, we find the brachial and femoral vessels represented by single tubes (figs. 16 and 17), *retia mirabilia* appearing only in the branches of these vessels in the distal third of the arm and thigh and in the forearm and leg.

Tarsius has been investigated by us because of the statement attributable originally to Vrolik (1826) and Burmeister (1846) that a vascular plexus is present in the lower extremity. Statements in the subsequent literature are confusing. Göppert (1905) claims that the brachial artery of *Tarsius* forms a tremendous *rete mirabile*. Fransen (1907) states that the external iliac artery of *Tarsius* gives rise to a plexus. Duckworth (1915) reports that the brachial artery bifurcates high up in the limb, but does not give rise to *retia*; he remarks merely that he observed two main vessels in the lower part of the thigh. Woollard (1927) does not describe a plexiform arrangement of the subclavian artery or its branches; of the external iliac artery, he says that as it emerges from under Poupart's ligament it breaks up into a number of branches which can be regarded as superficial and deep. The exact nature of the plexus in *Tarsius* has never been clearly demonstrated, a circumstance which leads Weber (1928) and others to assume *a priori* that the plexiform conditions in the limbs of *Tarsius* and of the lorises are identical. As we have already described, the brachial artery of *Tarsius* is a single tube unaccompanied by a plexus, whereas both femoral artery and vein exhibit simple multiple division. This diffuse plexus in the thigh is, however, quite different from the vascular bundle encountered in this region in the lorises.

The blood vascular bundles of the sloths, two-toed ant-eaters, lorises, four-toed ant-eater and pangolin are undoubtedly closely related in origin to the simple network type of plexus as found in *Myrmecophaga* and the Dasypodidae. Müller emphasizes the embryonic character of the simple network type of plexus. This he regards as the primitive form of blood vascular pattern; from it are derived both the bundle type and the usual single tubular artery. It has been established in man and other mammals that the various parts of the blood vascular system grow in the embryo as advancing plexuses of capillaries. Thus in the arm-buds the vascular beds are at first completely plexiform. As the buds grow, the plexuses extend peripherally. Subsequently there occurs a remodeling of the original plexuses, with the disappearance of much of the network and the formation of definitive efferent and afferent pathways, which by the acquisition of muscular and adventitial coats become the arteries and veins. In man

and the majority of mammals this remolding of the embryonic plexus leads in the arm to the establishment of a single principal artery in place of the original brachial *rete*. According to Müller's reasoning, in mammals which exhibit the arteries and veins in a plexiform condition throughout life, the resolution of the embryonic plexuses into single trunks does not take place. The vascular bundle type of plexus, as seen in the sloths and other mammals, is a highly specialized form of the original plexuses which have developed into a very different structure from the embryonic pattern.

Interesting also in this connection are the observations of Grodzinski (1930) upon the gradual metamorphosis of embryonic plexuses of blood vessels in the forelimb of developing salamanders. He observed that the embryonic pattern is eliminated earlier in the proximal portion of the extremity than in the distal portion. Applying this idea to the material under consideration, the proximal portions of the blood vascular beds of both extremities in *Manis*, *Tamandua*, *Myrmecophaga* and *Dasypus* have undergone complete differentiation into single trunks, whereas in the distal parts of these same vascular beds the plexiform pattern is not eliminated. In *Myrmecophaga* and *Dasypus* the general embryonic pattern is retained in the distal segments, but in *Manis* and *Tamandua* the original network is modified into the highly specialized bundle type of *rete*. In the sloths, two-toed anteater and lorises, on the other hand, the plexuses are not eliminated at all, either distally or proximally, but differentiate instead as complete vascular bundles.

Various hypotheses have been advanced to explain the functions of the *retia mirabilia*, but none of these are entirely satisfactory. Hyrtl maintains that the so-called massive plexuses (or bundles), as found in sloths, are related to slow movements, and he suggests that they may prevent obstruction of the circulation when the musculature is in a state of contraction. Müller explains that the ensheathed plexuses (or bundles) of the sloths facilitate the return flow of the blood from the limbs through the rhythmical pressure exercised upon the thin-walled veins by the arteries within the sheath. It has also been suggested that the *retia mirabilia* act as blood reservoirs. This idea is again advanced in a recent paper by Rau and Rao (1930).

Quite apart from any consideration of the specific functions of the *retia mirabilia* is the question of a possible correlation of the various types of such plexuses to modes of life. To recapitulate, our anatomical investigations emphasize the necessity (for the present, at least) of considering the sloths, the two-toed ant-eater and the lorises as pos-

sessing a distinct type of *rete mirabile*, the complete vascular bundle, in their extremities. From this group must be excluded the remainder of the lemurs and *Tarsius*, as well as the Dasypodidae and *Myrmecophaga*. The Manidae and *Tamandua* bear a transitional position to the sloths, *Cyclopes* and the Lorisinae. To pursue our discussion, do the animals named in the first group (sloths, two-toed ant-eater, lorises) exhibit any behavior or make any characteristic use of their limbs which other animals do not share? This, we believe, can be answered in the affirmative. They are all arboreal, but that does not distinguish them from many other groups of mammals. They possess, however, two other characteristics which do distinguish them in a marked degree from all other mammals: extreme slowness of movement, and the ability of the musculature to maintain the animal in hanging or clinging positions for an extraordinary length of time. For the sloths this has long been known, but one of the writers (Wislocki, 1928) has pointed out that, contrary to popular belief, the postures of the two sloths are quite different, the two-toed sloth alone being given to hanging in the way traditionally ascribed to sloths, whereas the usual posture of the three-toed sloth during rest is a clinging one with the axis of the body in the perpendicular plane, the horizontal hanging posture being assumed only during locomotion. Another difference between them is that the three-toed sloth (*Bradypus*) is more sluggish in its movements and progression than the two-toed sloth (*Cholœpus*). Like the sloths, the two-toed ant-eater, *Cyclopes*, clings habitually and is extremely sluggish and deliberate in its movements. Its postures resemble strikingly those of the three-toed sloth. Its marked similarity in these respects to the sloth is not generally appreciated.

Being familiar with the sloths and ant-eaters from actual observation of living specimens, it was interesting to us to observe a living specimen of one of the lorises, *Perodicticus potto*, which was kept in captivity for some length of time. During rest this animal's posture was habitually a clinging one, in the manner of the three-toed sloth. In locomotion along a horizontal branch it held its body in the normal quadrupedal position, instead of in the hanging position assumed by the sloths and *Cyclopes*. Moreover its movements were slow and deliberate, although by no means as sluggish as those of the sloths. When placed on the ground, *Perodicticus* walked slowly and awkwardly with legs bowed and the abdomen raised clear of the ground, contrary to the sloths, which are unable upon the ground to support the body upon the limbs. The sloths, two-toed ant-eaters and lorises constitute the group of animals in which complete vascular bundles occur in the extremities.

It is of interest to draw *Tamandua* and *Manis* into the comparison.

Tamandua, the four-toed ant-eater, is much more active than either the sloths or the two-toed ant-eater. Nevertheless, it, too, exhibits a certain awkward deliberateness of movement which is reminiscent of the sloths. Similarly *Manis*, although like *Tamandua* capable of executing fairly rapid movements in walking or climbing, is under most circumstances rather deliberate and slow and given to the maintenance of clinging postures. *Tamandua* and *Manis* are the two forms in which vascular bundles occur solely in the forearms and legs.

Myrmecophaga, which is terrestrial and active, shows contrariwise scarcely a trace of the deliberate slowness of the other Myrmecophagidae (*Cyclopes*, *Tamandua*). Similarly, *Dasypus*, which is a terrestrial animal, is extremely active. Both of these animals possess only limited, simple vascular networks.

Finally, *Tarsius* and the lemurs (exclusive of the lorises) are active arboreal animals exhibiting none of the sluggish movements or postural characteristics of the lorises, sloths or two-toed ant-eater. Our reinvestigation of the blood vessels of the extremities of these animals places their so-called vascular plexuses in an entirely different category from the vascular bundles under discussion in the sloths, lorises, *Cyclopes*, *Tamandua* and *Manis*.

The foregoing observations on the modes of life of animals possessing vascular bundles in the extremities suggest, we believe, that there is a correlation between the blood vascular bundles and the habitual postures and movements of these animals. The citation of these observations by no means establishes a relationship between the vascular bundles and the habitual postures of these animals, but the combination of the conditions in several widely separated mammalian groups suggests strongly such a possibility. The two appear to go hand in hand, and the similarity of the sloths, the two-toed ant-eater and the lorisine lemurs in these particulars can be interpreted best as instances of associated anatomical and functional convergences related to similar modes of life. Thus we return essentially to the original idea of Carlisle regarding a correlation between vascular bundles and sluggishness of movement.

The data which we have been discussing are briefly summarized in the accompanying table. The marked similarity of sloths, *Cyclopes* and lorises in respect to the pattern of the blood vessels to the extremities, as well as to mode of life, is apparent. The related and intermediate conditions in *Tamandua* and *Manis* are indicated. The Dasypodidae, *Myrmecophaga*, the Lemurinae and *Tarsius* differ, on the other hand, in both the character of their vascular patterns and their modes of life. There cannot, however, be said to be any correlation between simple plexiform patterns and active modes of life as

Genus	*Pattern of vessels to extremities*	*Mode of life, muscular activity*
Dasypus	Simple plexiform networks of certain of the vessels of forearm and leg.	Ground living. Extremely active. Rapidly repeated movements in digging.
Myrmecophaga	Simple plexiform networks of certain of the vessels of forearm and leg.	Ground living. Quite active.
Tamandua	Highly differentiated vascular bundles involving solely the main vessels of forearm and leg.	Largely arboreal. Less active than either of the preceding. Movements to some extent deliberate and slow.
Cyclopes	Highly differentiated vascular bundles involving the main vessels of upper arm and forearm, and thigh and leg.	Arboreal. Movements extremely slow and deliberate. Clinging postures maintained for long periods.
Cholæpus and *Bradypus*	Highly differentiated vascular bundles involving the main vessels of upper arm and forearm, and thigh and leg.	Arboreal. Movements extremely slow and deliberate. Clinging postures maintained for long periods.
Manis	Highly differentiated vascular bundles involving solely the main vessels of forearm and leg.	Largely arboreal. Movements to some extent deliberate and slow.
Lorisinae	Highly differentiated vascular bundles involving the main vessels of upper arm and forearm, and thigh and leg.	Arboreal. Movements slow and deliberate. Clinging postures maintained for long periods.
Lemurinae	Extremely simple plexiform networks involving certain branches of vessels to the extremities.	Arboreal. Extremely active.
Tarsius	Simple, multiple division of the femoral artery.	Arboreal. Extremely active.

postulated by Hyrtl. A brief consideration of various active groups of mammals would amply demonstrate this. As has been said, it is likely that the simple networks are a widespread, less differentiated, primitive condition. Consequently, in the order of the Xenarthra, the vessels to the extremities are primitive in the Dasypodidae and *Myrmecophaga*, partially specialized in *Tamandua*, and highly specialized in *Cyclopes*, *Bradypus* and *Cholœpus*.

It is of interest to note that the striated musculature of the Bradypodidae is uniformly of an exceedingly dark red variety (Wislocki, 1928). We have also noted the same circumstance in unrelated *Perodicticus*. In the Dasypodidae, on the other hand, the striated musculature is mixed pale red and white. In the other animals under consideration the character of the musculature in freshly killed specimens is unknown. These findings, nevertheless, suggest that dark red coloration possibly characterizes the musculature of those mammals in which there is habitual sluggishness of movement.

Summary

At least two types of *retia mirabilia* or blood vascular plexuses are found in the extremities of mammals. The one type comprising the majority of *retia*, which are probably primitive, consists of simple plexiform anastomoses. The other type, consisting of highly organized vascular bundles, is probably a very specialized structure.

Typical vascular bundles involving the whole course of the brachial and femoral arteries and their ultimate major divisions are encountered in the two-toed and three-toed sloths (*Cholœpus* and *Bradypus*), the two-toed ant-eater (*Cyclopes*) and in the Lorisinae. Typical vascular bundles involving only the vessels of the forearm and leg are encountered in the pangolin (*Manis*) and the four-toed ant-eater (*Tamandua*). The great ant-eater (*Myrmecophaga*) and the armadillos, on the other hand, possess *retia mirabilia* of the simple anastomosing type.

Tarsius possesses *retia* only in its lower extremities, involving each femoral artery. The latter, however, does not form a typical vascular bundle, as in the sloths and lorises, but breaks up completely into a set of small radiating arteries.

The typical vascular bundle occurs only in sluggish arboreal animals. The sloths and lorises, in which the bundles are typically seen, are phylogenetically only distantly related. This circumstance suggests that these vascular bundles have developed in these forms as adaptive convergences to their similar modes of life.

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EXPLANATION OF PLATES

PLATE 1

PLATE 1

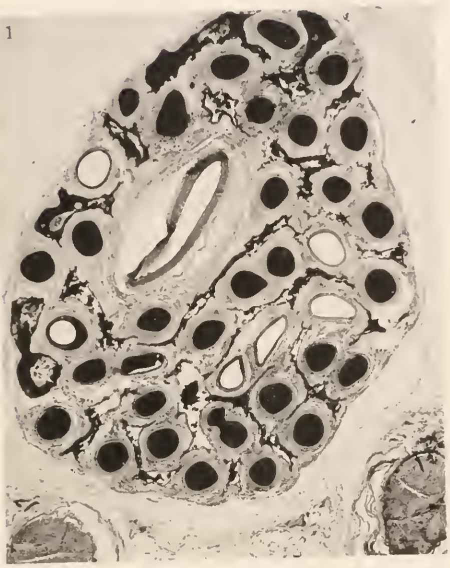
Fig. 1. Typical cross-section of the upper arm bundle of the three-toed sloth (*Bradypus griseus*) showing the brachial artery surrounded by a *rete mirabile* of smaller arteries and veins. The entire vascular bundle is enclosed and held together by a dense connective tissue sheath. The vessels are filled with an India ink injection mass. × 20.

Fig. 2. Typical cross-section of the thigh bundle of the three-toed sloth (*Bradypus griseus*) showing the femoral artery and its associated *rete mirabile* of smaller arteries and veins. The entire structure is held together by dense fibrous tissue. Vascular injection with India ink. × 20.

Fig. 3. Typical cross-section of the upper arm bundle of the didactyl ant-eater (*Cyclopes didactylus*) showing an association of a *rete mirabile* with two stout arteries. × 20.

Fig. 4. Typical cross-section of the thigh bundle of the didactyl ant-eater (*Cyclopes didactylus*) showing a similar association of a *rete mirabile* of small arteries and veins with two larger arteries. × 20.

The four figures on this plate illustrate the close similarity of the conditions found in the upper arm and thigh blood vessels of sloths and didactyl ant-eater. Each of the sections is magnified twenty times, the upper arm bundles of the sloths being absolutely larger than those of the smaller didactyl ant-eater. The sloth material was well preserved and shows good detail; the material from the didactyl ant-eater was taken from an old alcohol-fixed museum specimen. Nevertheless the latter is well enough preserved to show the similarity of the vascular bundles in the two forms.



HELIOTYPE CO. BOSTON

PLATE 2

PLATE 2

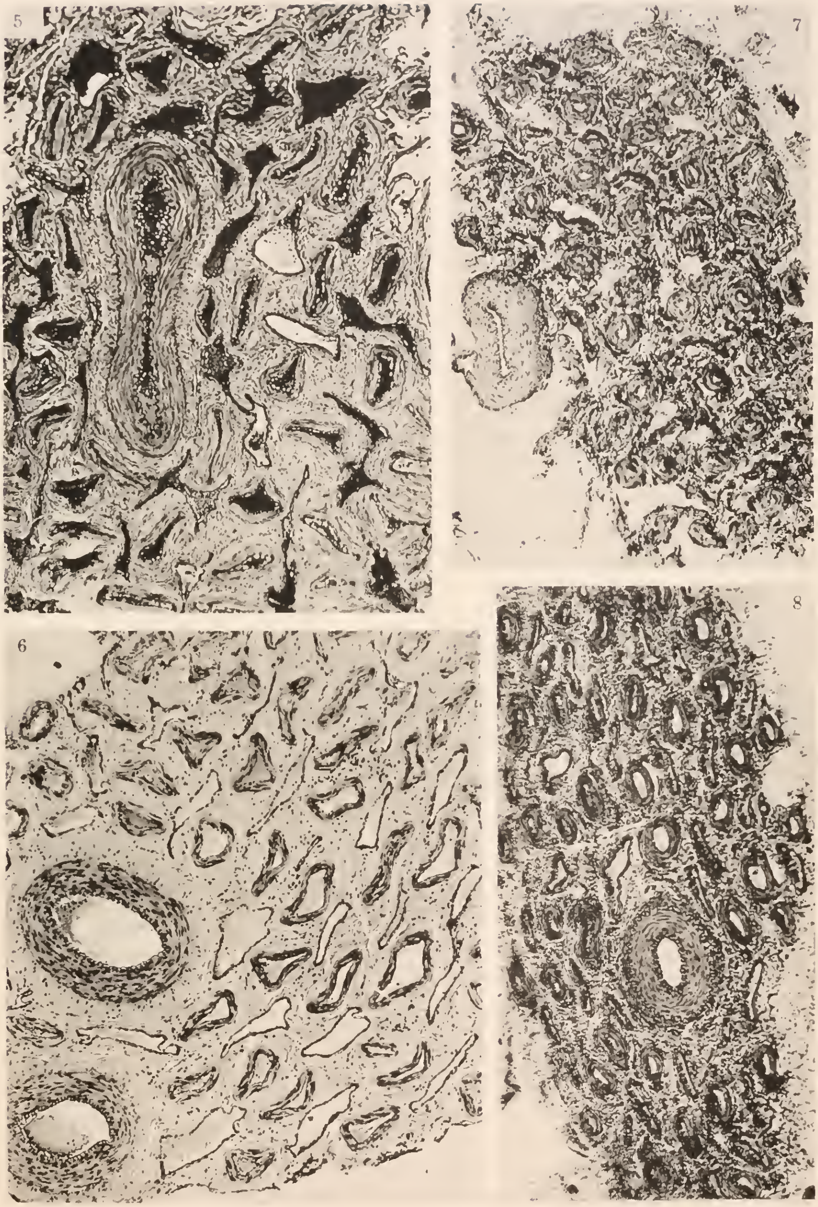
Fig. 5. Typical cross-section of the upper arm bundle of a slow lemur, *Perodicticus potto*, showing the brachial artery surrounded by a *rete mirabile* composed of smaller arteries and veins, the whole bound together by dense connective tissue. × 50.

Fig. 6. Typical cross-section of the thigh bundle of *Perodicticus potto*, showing two main arteries surrounded by a *rete mirabile* of smaller arteries and veins. × 50.

Fig. 7. Typical cross-section of the upper arm bundle of another one of the lorises (*Nycticebus borneanus*) showing the brachial artery in association with a *rete mirabile*. × 50.

Fig. 8. Typical cross-section of the thigh bundle of *Nycticebus borneanus*. × 50.

These four figures, all at the same magnification, show the typical character of the vascular bundles of upper arm and thigh in the lorises. Notice that they are practically identical with the vascular bundles involving the brachial and femoral arteries of the sloths and didactyl ant-eater. The material from *Perodicticus* is well preserved from a fresh specimen, that from Nycticebus is from an old alcoholic museum specimen.



HELIOTYPE CO. BOSTON

PLATE 3

PLATE 3

Fig. 9. Typical cross-section of the brachial artery of one of the *Lemurinae* (*Lemur variegatus*). Note that the artery is relatively large and that it is not associated with a *rete mirabile*. It is accompanied by a brachial vein of about equal size. × 50.

Fig. 10. Typical cross-section of the femoral artery and vein of *Lemur variegatus*. Note that artery and vein are of about equal size and relatively large and that they are not associated with a *rete mirabile*. × 50.

Fig. 11. Typical cross-section of the brachial artery of *Tarsius fraterculus* showing a relatively large artery which is not accompanied by a *rete mirabile*. The tissues from this *Tarsius* are poorly preserved, but show nevertheless the topography under discussion. × 50.

Fig. 12. Typical cross-section through the thigh of *Tarsius fraterculus*. Note that there is no main artery. Observe also that there is no vascular bundle. Instead there are scattered clusters of arteries and veins of about equal size and number which are not ensheathed by dense connective tissue capsules. The femoral plexus in *Tarsius*, produced by radial branching, is morphologically dissimilar from the vascular bundles of the sloths, didactyl ant-eater and the lorises. × 50.

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PLATE 4

PLATE 4

Fig. 13. Typical cross-section of the brachial artery of the four-toed ant-eater (*Tamandua tetradactyla*). Note the relatively large size of the artery and that it is not associated with a *rete mirabile*. × 20.

Fig. 14. Typical cross-section of the femoral artery of *Tamandua tetradactyla*. This vessel also is not associated with the formation of a vascular bundle, differing in this respect from the didactyl ant-eater and the sloths. × 50.

Fig. 15. Cross-section of the radial bundle of *Tamandua tetradactyla*, showing the typical vascular bundle formation in the arteries of the forearm. × 20.

Fig. 16. Typical cross-section of the brachial artery of *Manis javanica*, showing the single, large artery devoid of a vascular bundle. × 50.

Fig. 17. Typical cross-section of the femoral artery of *Manis javanica*, showing a single larger artery in the absence of a vascular bundle. × 50.

Fig. 18. Cross-section of the tibial vascular bundle in *Manis javanica*, illustrating that the arteries of the leg give rise to typical vascular bundles. × 20.

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Bulletin of the Museum of Comparative Zoölogy

AT HARVARD COLLEGE

Vol. LXXIV, No. 2

A STUDY OF THE OSTEOLOGY OF ALLIGATOR PRENASALIS (LOOMIS)

By Charles C. Mook

With Three Plates

CAMBRIDGE, MASS., U. S. A.

PRINTED FOR THE MUSEUM

July, 1932

PUBLICATIONS

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY

AT HARVARD COLLEGE

There have been published of the Bulletin Vols. I to LXV, LXVII–LXXIII; of the Memoirs Vols. I to LI.

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No. 2.—*A Study of the Osteology of Alligator prenasalis* (*Loomis*)

By Charles C. Mook[1]

Introduction

In prospecting for fossil mammals in the Oligocene beds of South Dakota in 1925, Messrs. Hugo and Eric Schlaikjer discovered some well preserved crocodilian remains. These remains were taken up in the field and shipped to the Museum of Comparative Zoölogy at Cambridge, Massachusetts, and were presented to that institution by Dr. Thomas Barbour. The locality of this occurrence of fossil crocodiles is fifteen miles southwest of Scenic, South Dakota, and the level is the Titanotherium Beds of the White River Formation, of Lower Oligocene age. The bones were found one hundred and thirty-four feet above the Cretaceous-White River contact, and forty-eight feet below the base of the lower Oreodon Beds.

The specimens consist of two individuals, both well preserved, but neither of them perfect. Between them they exhibit the characters of nearly all parts of the skeleton. These fossils were noted in a brief article by Dr. Barbour in Copeia, No. 151, pp. 109–111, 1926, and were correctly identified by him as belonging to *Alligator prenasalis* (Loomis). The writer is indebted to Dr. Barbour for the opportunity of studying and describing this material, and to Prof. Henry Fairfield Osborn, of the American Museum of Natural History, who assigned a grant from the Osborn Research Fund, which defrayed the cost of the drawings. The photographs were made at the Museum of Comparative Zoölogy, and the drawings were made by Mr. John C. Germann and Mrs. Louise W. Germann, of the American Museum of Natural History.

General Form of the Skull

Alligatoroid, the lateral margins are regular, converging very gradually forward in practically straight lines from the posterior tip of the quadratojugal to the level of the third maxillary teeth; from this point forward they curve inward sharply to meet at the mid-line at the tip of the snout. The convergence of the posterior portions is considerably greater than in the modern alligator.

This convergence of the borders is correlated with a relatively greater breadth of the posterior portion of the skull in the specimens

[1] Contributions to the Osteology, Affinities, and Distribution of the Crocodilia No. 22.

described than in the Florida alligator. The difference in breadth between the anterior and posterior portions of the skull is less in *A. mississippiensis* than in the South Dakota specimens. This is equally

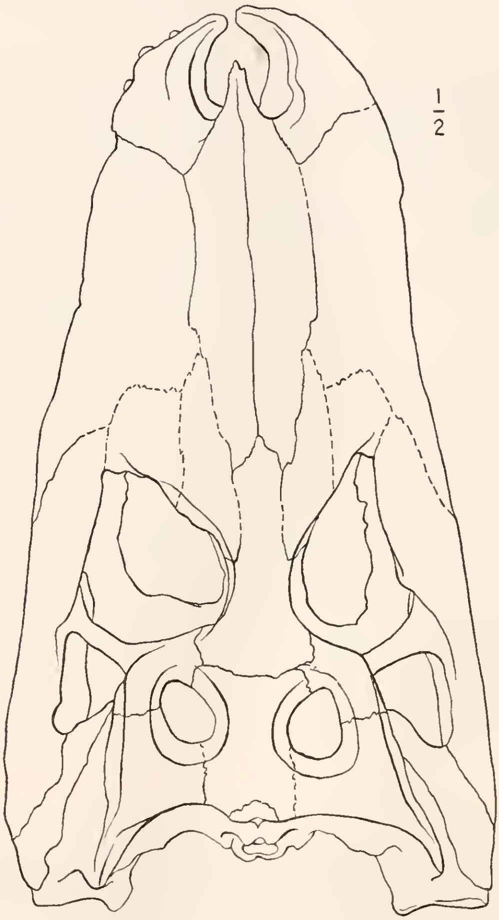


Fig. 1. *Alligator prenasalis* (Loomis). Skull, superior view. One-half natural size. Mus. Comp. Zoöl. No. 1,015.

true whether juvenile or adult specimens of *A. mississippiensis* are used for comparison.

In cross profile the skull is higher than in either of the living species of *Alligator* or in *A. thomsoni*. This is especially true along the mid-line

of the snout. The nasal bones are elevated above the premaxillaries. The interorbital region of the frontal slopes gradually to the surface of the nasals, without an abrupt descent as in other alligators and in

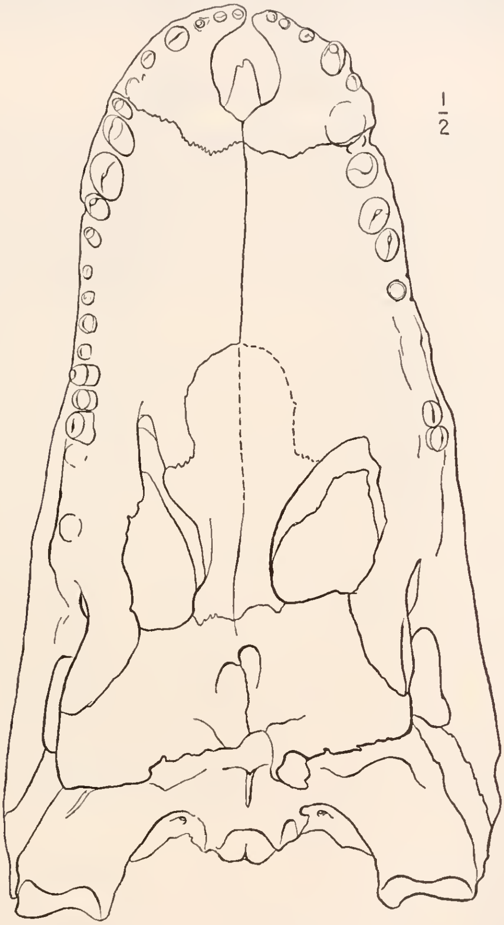


Fig. 2. *Alligator prenasalis* (Loomis). Skull, palatal view. One-half natural size. Mus. Comp. Zoöl. No. 1,015.

the living *Jacare*. This fact is the more notable because it is apparent in spite of slight crushing in a direction that would tend to obscure it.

The cranial table is larger in every way than in the Florida or Chinese alligators. It is slightly longer, and is considerably broader,

especially along the posterior border. Like the lateral borders of the skull as a whole, the lateral borders of the cranial table converge more sharply forward than in the living alligators. The space between the orbits is narrower and that between the supratemporal fenestrae wider than in the living alligator.

Fenestrae of the Skull

The supratemporal fenestrae are larger than in the living alligators, occupying more of the area of the cranial table. They are semicircular posteriorly; their external borders are nearly straight antero-posterior lines; their antero-internal borders bend sharply forward and outward from opposite the centers of the fenestrae, giving the latter an asymmetric appearance, with pointed ends directed forward and outward.

The orbits are similar in shape to those of the living alligators, but are relatively larger.

The external narial opening is characteristic. It is very broad. In the living alligators the nasal bones extend forward and join the premaxillaries in front of the narial aperture, thus separating the latter into two distinct orifices, at least at the surface. In *A. thomsoni* the nasals extend forward into the aperture, but do not reach the premaxillaries in front of it. This may be due to incomplete preservation, as the tip of the nasal projection in the living forms is very delicate. In the specimens now described the nasals project forward but do not reach the anterior cross-bar of the maxillaries. The anterior border of the aperture is low and the lateral and anterior premaxillary surfaces slope gradually up to the exterior making the aperture shallow except in its center. The low anterior border gives the aperture the appearance of being directed forward. This form of the aperture corresponds exactly with that in the type of *Alligator prenasalis* Loomis, and differs from all other known species of crocodilians.

The lateral temporal fenestra is similar in shape to that in modern alligators, but is relatively larger.

On the palate the premaxillary fenestra resembles in size and shape that of the living alligators.

The palatine fenestra is distorted on both sides in both specimens. On analyzing the effects of this distortion it becomes apparent that the palatine fenestrae were shorter and broader, and were nearer together than in the Recent alligators. Their external borders were also farther from the tooth row. In other words the fenestrae are situated nearer the mid-line than in the Recent alligators.

Mandible

The lower jaws are more massively constructed than are those of the Recent alligators. The symphysis is longer, evidently being opposite eight teeth on each side. (The dental borders of No. 1015 are

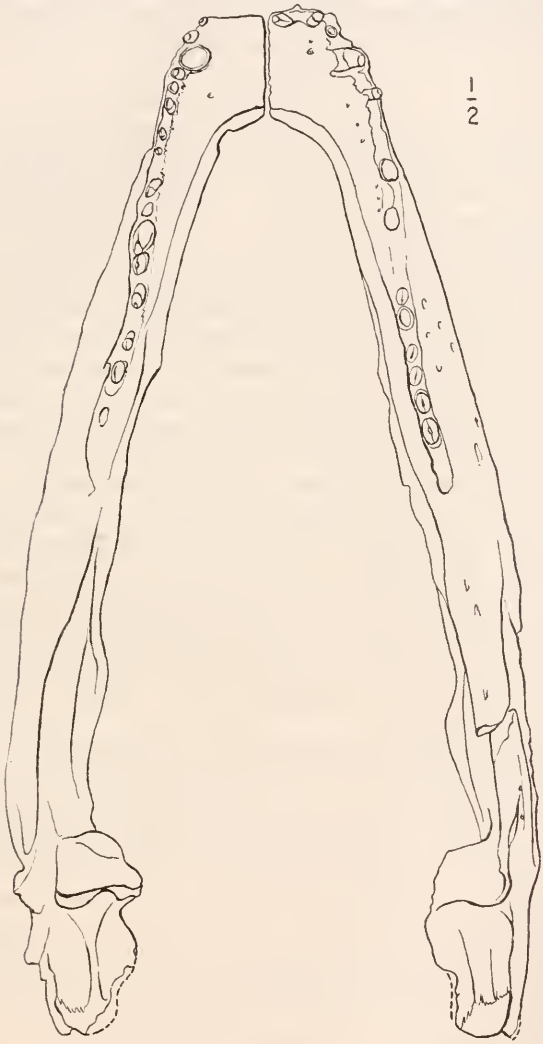


Fig. 3. *Alligator prenasalis* (Loomis). Lower jaws, superior view. One-half natural size. Mus. Comp. Zoöl. No. 1,015.

incomplete, and those of 1014 are covered, so this point cannot be definitely determined at present.) The splenials definitely enter the symphysis and form its posterior border.

The shaft of each ramus is broad and moderately high.

The external mandibular fenestra is not well preserved in either specimen. In the right ramus of 1015, however, its outlines are distinct enough to indicate that its size was small.

Dentition

In No. 1014 the dentition is partially obscured because the lower jaws are firmly attached to the skull. In No. 1015 the alveolar borders are somewhat damaged. No positive statement can be made, therefore, regarding the dental formula.

In 1014 four premaxillary teeth are present on each side, but these do not exactly correspond in position with each other, or with the teeth of 1015. They indicate that the complete jaw had five premaxillary teeth on each side. In 1014 the left side has three premaxillary teeth and spaces for two alveoli between the anterior of the three and the mid-line. The right premaxillary has four teeth, and the alveolus of a fifth. Two of the teeth in the right premaxillary correspond with an incomplete border in the left.. It appears, therefore, that five is the characteristic number of teeth for each premaxillary.

In No. 1015 the right maxillary contains twelve actual teeth and an incomplete posterior groove that must have held at least two, and possibly three more teeth. There is a space between the anterior maxillary tooth and the posterior premaxillary tooth that may have lodged a small tooth. The left maxillary contains five actual teeth, and the border is incomplete, so the original number cannot be determined. The number of maxillary teeth on each side indicated by this specimen is sixteen.

In No. 1014 ten teeth are present in the right maxilliary, with clear indication of two more. The posterior portion of the alveolar border is not clearly visible, but three more teeth in this region seems likely.

The left maxillary contains fourteen teeth in a continuous series from the premaxillary suture backward. The posterior end of the alveolar border is not visible, but indications are present that another tooth was lodged back of No. 14. On the whole the evidence points toward fifteen teeth in each maxillary. This added to the five premaxillary teeth noted above, makes twenty teeth on each side of the upper jaw.

The lower teeth of No. 1014 are entirely invisible in the specimen.

In No. 1015 ten teeth are preserved on the right side and fourteen on the left. The anterior border of the lower jaw is incomplete, making it difficult to estimate the number of teeth opposite the symphysis. The posterior dental borders are also more or less incomplete. Judging from the size, shape, and spacing of the visible teeth and alveoli the number of mandibular teeth on each side was twenty or twenty-one, and more probably twenty-one than twenty. Probably eight teeth were opposite the symphysis on each side.

The teeth themselves are very stoutly constructed. In the premaxillaries the first, second and fifth teeth are small, the third is of moderate size and the fourth is the largest. The premaxillary teeth are about evenly spaced with each other.

In the maxillaries the first two teeth are small and are very close together. The third is very much larger, while the fourth is almost gigantic in size. In the interlocked position of the jaws in No. 1014 the upper third maxillary tooth projects downward as far as the lower border of the mandible. The fourth maxillary tooth projects considerably below this level. The volume of the third and fourth maxillary teeth may be estimated at about eight times that of corresponding teeth in a Florida alligator of approximately the same size. All of the teeth thus far noted are asymmetrically conical, with relatively long crowns. The next tooth (fifth maxillary) is small. It has a short subconical crown. The sixth and seventh, and to a certain extent the eighth maxillary teeth are very small. Their crowns are very short vertically. They are much longer antero-posteriorly than they are broad laterally, at the same time they are sharp pointed.

Posterior to the eighth the maxillary teeth are of moderate size, with long roots and short blunt crowns, very similar to those of *Allognathosuchus* of the Paleocene and Eocene.

The surfaces of the crowns of all the teeth have very fine vertical striations. In the anterior teeth these are so faint that they do not interfere with a smooth or polished appearance of the teeth. Posterior to the fourth maxillary tooth, however, they are distinct enough to give a satiny appearance to the crowns.

The order in size of some of these teeth will be:

largest ....4th maxillary
second largest..................................3rd maxillary
third largest ....4th premaxillary

The mandibular teeth are not visible in No. 1014 and are incomplete in No. 1015. Apparently there was a medium to small-sized tooth near the symphysis, then two slightly larger, the fourth con-

siderably larger, then eight or nine small teeth in the anterior sag of the dentary, then a much larger tooth, posterior to which the teeth gradually decreased in size. The total number of lower teeth is uncertain. It was probably twenty-one in each ramus.

The Bones of the Skull

Premaxillaries. The premaxillaries are short and broad. Their sutures with the nasals extend back as far as the level of the large fourth maxillary tooth. On the borders of the skull the premaxillo-maxillary sutures lie opposite the posterior third of the external narial aperture. On the palate the suture is covered in No. 1014 and it is obscure in No. 1015. It is certain however, that it did not extend back of the level of the second maxillary tooth. The posterior premaxillary processes on the dorsal surface are not sharply differentiated from the principal mass of the bone. The premaxillary teeth are subequally spaced from each other. The rim that borders the narial aperture is elevated at the postero-external edges, leaving a very narrow space between their bases and the premaxillo-maxillary suture. The anterior and antero-external portions of the narial rim are depressed.

Maxillaries. The maxillaries are short and broad. They occupy somewhat less of the total breadth of the skull on the snout than in the Florida alligator, the nasals being somewhat broader. Their sutures with the nasals are nearly straight lines that are almost parallel, converging only very slightly forward. These sutures are relatively much shorter than in the Florida alligator. The sutures with the prefrontals are about the same length in *A. mississippiensis*. The sutures with the lachrymals are similar in form to those of the latter species.

The maxillaries occupy most of the palate. The maxillo-palatine suture is somewhat obscure in both specimens, but it appears to curve forward and inward regularly from the anterior or antero-internal border of the palatine fenestra on one side to the mid-line near the level of the seventh maxillary tooth and similarly outward and backward to the other side. The suture with the ectopterygoid is covered by the mandible in No. 1014 and is somewhat obscured in No. 1015. It is evident, however, that it is somewhat longer than in *A. mississippiensis*.

The first ten maxillary teeth are variously spaced on the opposite sides of the two specimens, and have separate alveoli. The posterior maxillary teeth are close together and are lodged in a common alveolar groove.

Nasals. These bones are broad, occupying a slightly greater portion

of the total breadth of the snout than in *A. mississippiensis* or *A. sinense*. The process entering the narial aperture is broader and blunter than in the Florida alligator. The breadth of the portion of the posterior border of the narial aperture occupied by the nasals is 18 mm. in No. 1014, compared with $13\frac{1}{2}$ mm. in a Florida alligator skull of the same length (Am. Mus. No. 7122).

The nasals extend back as far as the eleventh maxillary tooth. In *A. sinensis* (Am. Mus. No. 23,900) they extend to the level of the eleventh maxillary tooth, and in *A. mississippiensis* they extend back to the twelfth to fifteenth maxillary teeth (Am. Mus. Nos. 7,122 and 9,043 respectively). It is possible that this character may be correlated somewhat with the individual age of the specimen.

The short contact between the nasals and the maxillaries has been mentioned above. The contact with the prefrontals is long, measuring 25 mm. as against 20 in a Florida alligator of the same skull length.

Lachrymals. In No. 1015 the lachrymal borders are not sufficiently preserved to warrant description. The lachrymals are well preserved in No. 1014 and the following description is based upon that specimen. The bone is somewhat larger than in *A. mississippiensis*, and extends forward to the level of the eighth premaxillary tooth instead of to the tenth or eleventh as in *A. mississippiensis* or the ninth as in *A. sinense* (Am. Mus. 23,900 juv.) The suture with the prefrontal is longer than in the living American species. The wedge of the bone lying between the inferior border of the orbit and the jugal bone is narrower than in the latter species. As in both species of living alligators the lachrymals have no contacts with the nasals, and their longitudinal axes, or axes of greatest length, are parallel with the longitudinal axis of the skull.

Prefrontals. These bones are extremely long and slender. In this respect they greatly exceed *A. mississippiensis* in which the prefrontals are long and slender. Their sutures with the maxillaries are less than one-half as long as their sutures with the nasals, and about one-fourth the length of their contact with the frontal.

Frontal. The anterior process of the frontal is long and slender. It is relatively longer than in an *A. mississippiensis* specimen of the same skull length (Am. Mus. 7,122) but is relatively shorter than in an older *A. mississippiensis* skull (Am. Mus. No. 9,043.) Its relative length is therefore to be correlated with the variation in snout length depending upon the individual age of the specimen. The interorbital plate is narrow, and its edges are not uprolled in either specimen. The expansion posterior to the orbits is very slight.

Postorbitals. These bones are not especially characteristic. The differences between them and the postorbitals of a given *A. mississippiensis* skull are less than the differences between various skulls of *A. mississippiensis.*

Squamosals. The squamosals, like the postorbitals, are very similar to those of the Recent Florida alligator

Parietal. There is nothing particularly distinctive about the parietal. As in both Recent species it occupies the central region of the posterior border of the cranial table, confining the supraoccipital to the posterior surface of the skull.

Supraoccipital. As in the living alligator the supraoccipital is confined entirely to the posterior surface of the skull, forming no part of the posterior border of the cranial table. Its boundaries cannot be made out in No. 1015 and are somewhat obscure in No. 1014. Its breadth is three-sevenths of the breadth of the postoccipital surface. Its height is uncertain, but it is probably about one-half of the distance from the cranial table to the superior border of the foramen magnum; this is somewhat less than in *A. mississippiensis.*

Exoccipitals, Basioccipital, and *Basisphenoid.* These bones differ in no essential characters from those of modern alligators, and need no special description.

Quadrates. The quadrates are very broad and stout compared with those of the living alligators. The breadth of the glenoid surface is about four-thirds of that of a Florida alligator of the same skull length.

Quadrato-jugals. These bones are somewhat stouter than in the living alligators. The flanges of bone separating the quadrates from the postero-internal borders of the lateral temporal fenestrae are unusually broad. The quadrato-jugals also occupy slightly more of the external border of this fenestra than in the living alligators.

Jugals. The jugals are somewhat longer and more slender than in the living alligators. Their anterior boundaries are at the level of the tenth maxillary tooth rather than the eleventh or twelfth as in *A. mississippiensis* In *A. sinense* they are over the ninth or tenth maxillary tooth. Individual age undoubtedly influences this character somewhat.

Palatines. These bones extend forward to the level of the eighth maxillary tooth. The sutures with the maxillaries curve forward from the palatine fenestrae to meet at the mid-line, contrasting with *A. mississippiensis* and *A. thomsoni,* but resembling more *A. sinense.* Their sutures with the pterygoids are slightly farther forward than in *A. mississippiensis.*

Pterygoids. The pterygoids are somewhat crushed in both specimens. It is clear, however, that they are short antero-posteriorly, and that they occupy small portions of the internal borders of the palatine fenestrae as well as the posterior borders. Crushing has slightly modified the borders and position of the internal narial aperture, but there can be no doubt that it was situated slightly farther forward than in *A. thomsoni*, *A. sinense* and *A. mississippiensis.* In this respect it is intermeditae between these forms and *Allognathosuchus mooki* Simpson, from the Paleocene. The total breadth of the 19 pterygoids is much greater than in modern forms.

Ectopterygoids. These bones differ in no essential characters from those of living alligators except that they are more stout.

Mandible

The mandible is very broad, both at the symphysis and at the posterior end. The symphysis is considerably longer than in the living alligators, extending backward to the level of the eighth or ninth maxillary tooth. The exact level cannot be determined as the teeth are not visible in No. 1014, and in No. 1015 are incomplete. The individual rami are thick laterally, and they diverge rapidly in the posterior direction. Consequent upon these facts the symphysial surface, viewed from above, is much larger than in living alligators. The external mandibular fenestra is rather short, being about one-eighth as long as the entire jaw, compared with fifteen to eighteen per cent in both species of living alligators. The height of the jaw is slightly less than in modern alligators.

The individual bones of the mandible are not especially characteristic. It may be noted that the splenials enter and form a small part of the symphysis as in the living alligators. The articular bone is broader than in the Recent forms.

Scapula and Coracoid

The scapula of the left side is fairly well preserved; that of the right side being fragmentary. The length of the left scapula compared to the breadth of the shaft and of the distal end is small compared with *C. americanus* and *A. mississippiensis.* In other words the scapula is unusually short. The surface for articulation with the coracoid is more oblique than in the living Florida alligator and crocodiles. This makes a somewhat different angulation between the scapula and the coracoid than in the modern forms. The process on the antero-external

border is unusually prominent but this may have been accentuated by crushing.

Both coracoids are well preserved. Like the scapulae they are short and stout. Otherwise they resemble the coracoids of the modern alli-

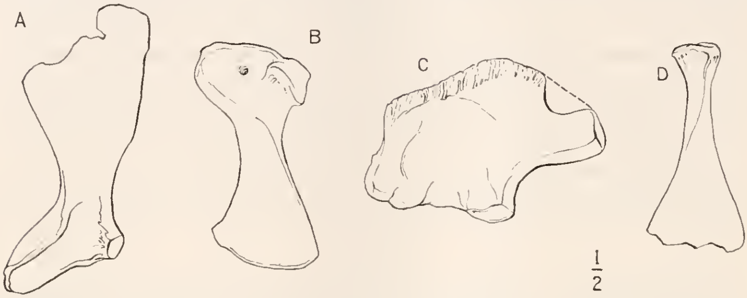


Fig. 4. *Alligator prenasalis* (Loomis). A, Left scapula, external view; B, left coracoid, external view; C, left ilium, external view; D, left pubis, external view. One-half natural size. Mus. Comp. Zoöl. No. 1,014.

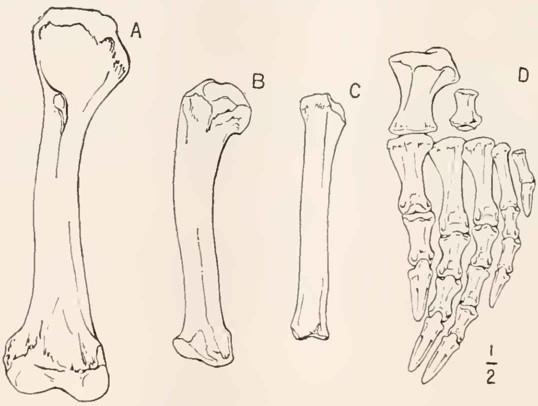


Fig. 5. *Alligator prenasalis* (Loomis). A, right humerus, anterior view; B, right ulna, external view; C, right radius, external view; D, left manus, superior view. One-half natural size. All views Mus. Comp. Zoöl. No. 1,014, except one ungual phalanx, which is No. 1,015.

gator in form. The coracoid foramen is somewhat nearer the midline than in the Florida alligator and much nearer than in the Florida crocodile. As noted in the discussion of the scapula the angulation between the scapula and the coracoid is somewhat different from that

of modern crocodilians. The long axes of the two bones are somewhat more nearly parallel than in *A. mississippiensis*, and much more nearly parallel than in *C. americanus*.

Humerus

Both humeri are well preserved and the characters noted may be observed equally well on both of them. The humerus is longer in proportion to the breadth of the proximal end than in the Florida alligator and the Puerco *Allognathosuchus* but is shorter than in *Crocodilus americanus*. The same is true with respect to the distal end and the circumference of the shaft. The tip of the deltoid crest is relatively nearer the center of the bone than in *C. americanus* and *A. mississippiensis*, but less near than in *Allognathosuchus mooki*. The crest projects farther from the anterior surface of the bone than in any of these species.

Measurements and Ratios

	Am. Mus. 7139 Rt. Hum. (*Crocodilus americanus*)	Am. Mus. 6780 Left Hum. (*Allognathosuchus mooki*)	Am. Mus. 31822 Rt. Hum. (*Alligator mississippiensis*)	Mus. Comp. Zool. 1014 Rt. Hum. (*Alligator prenasalis*)
Length, median	259	130	158	100
Length, maximum	274	137	162	103
Breadth prox. end	72	44	50	28
Breadth distal end	66	39	47	27
Breadth shaft minimum	30	18	21	15
Circumference of shaft minimum	103	63	77	44
Index: Circumference over maximum length	376	459	475	427
A Center of proximal end to center of deltoid crest	74	42	53	35
B Center of deltoid crest to center of distal end	215	99	128	75
Ratio A over B	349	424	414	493
Ratio, length median over length of femur median	794			798
Ratio, length median over length of ulna median	1497	1326	1254	1282
Ratio, length median over length of radius median	1762	1547	1436	1492

Radius and Ulna

The radius and ulna are present on both sides and are well preserved. They resemble the corresponding bones of *A. mississippiensis* and other alligatorid crocodilians to such a degree as to render detailed description unnecessary.

Measurements

	Left ulna	Left radius
Length	78	67
Maximum thickness of shaft	5	6
Ratio, length over length of humerus . .	764	656

Carpus and Manus

The carpus and manus are well preserved on both sides. The carpus consists of a very large radiale and a very small ulnare. The radiale is usually considerably larger than the ulnare in crocodilians, but in this case the discrepancy is size between the two bones is unusually great. In form these bones do not differ materially from those of living crocodilians.

Four metacarpals (I–IV) are preserved in the left manus and four and a half in the right (I–IV, $\frac{1}{2}$ V). Metacarpals II and III are subequal in size, and are much larger than I and IV. I is moderately short and stout. II is longer than I, being the longest of the five, and is more slender than I.

The phalanges are well preserved. The formula appears to be 2.3.4.3.2. The third digit is somewhat longer and stouter than the others.

Pelvic Girdle

Both ilia are preserved, the left one sufficiently well for comparison with the ilia of other forms. Its vertical diameter is relatively greater in proportion to its length than in *Alligator mississippiensis*. The length of the inferior border, including the pubic and ischiadic peduncles, is relatively greater than in the Florida alligator. The anterior border of the bone is less oblique to the superior and inferior surfaces than in the latter species.

On the inner surface the rugosities that connect with the sacral vertebrae are definitely separated by a short space of smooth bone. In *A. mississippiensis* the rugose areas are continuous.

Measurements and Ratios

	Mus. Comp. Zoöl. 1,014	Am. Mus. 31822
Length of ilium	62 mm.	97 mm.
Height	43	58
Ratio, height over length	693	598
Length of inferior border	40	61
Ratio, length of inferior border over length	663	628

The left ischium is fragmentary. The right ischium is fairly well preserved, but its pubic peduncle is missing. The bone is relatively short, and the pubic process is elevated considerably above the level of the iliac articular surface. The anterior border of the bone is bent sharply inward. No such character is present in the ischium of the Florida alligator.

Measurements and Ratios

		Mus. Comp. Zoöl. 1,014 Left ischium	Am. Mus. 31,822. Left ischium
A	Length, iliac peduncle to tip	57	101
B	Length, total	64 est.	107
C	Breadth of distal end	32	54
D	Breadth of shaft	14	21
	D/A	245	208
	C/A	561	534

Both pubes are present in the specimen, but they are poorly preserved. So far as they show any characters at all they resemble the corresponding bones of *A. mississippiensis*.

Femur

Both femora of No. 1,014 are well preserved. They resemble the femur of the Florida alligator closely. The head is somewhat flatter than in the latter species, but that may be partly due to crushing. The apex of the deltoid crest is slightly nearer the center of the shaft than in the living form; the outline of the distal end is somewhat more irregular.

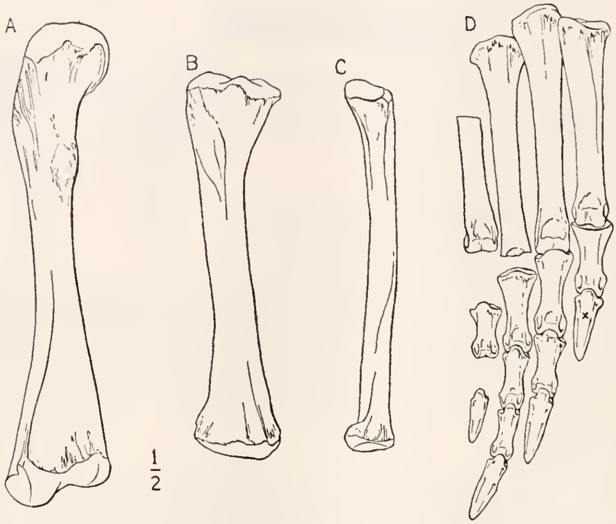


Fig. 6. *Alligator prenasalis* (Loomis). A, left femur, (reversed) posterior view; B, right tibia, anterior view; C, right fibula, internal view; D, right pes, superior view. One-half natural size. All views Mus. Comp. Zoöl. No. 1,014, except ungual phalanx marked x, which is No. 1,015.

Measurements and Ratio

	Amer. Mus. 7139 Right femur (*Crocodilus americanus*)	Amer. Mus. 6780 Right femur (*Allognathosuchus mooki*)	Amer. Mus. 31822 Right femur (*Alligator mississippiensis*)	Mus. Comp. Zool. 1014 Right femur (*Alligator prenasalis*)
Length, median	325mm.	174	183	129
Length, maximum	317	164	179	124
Breadth, proximal end	68	42	44	29
Breadth, distal end	71	36	45	30
Breadth of shaft, minimum	30	21est.	21	10
Circumference of shaft, minimum	120	72est.	78	49
Index: circumference over maximum length	369	413est.	435	380
A Center of proximal end to center of 4th trochanter	114	63	67	45
B Center of 4th trochanter to center of distal end	203	101	112	79
Ratio A over B	561	623	598	580
Ratio, length, median, over length of tibia .	1448	1333	1251	1227
Ratio, length, median, over length of fibula .	1495	1366	1306	1278

Tibia and Fibula

Both tibiae and the left fibula are preserved in No. 1,014 and the right fibula in No. 1,015. These bones are somewhat more slender than the corresponding bones of *Alligator mississippiensis*, but otherwise they are not especially characteristic. The tibiae are somewhat flattened at their distal ends, but that may be due to crushing.

Measurements

	Mus. Comp. Zool. 1015 (*Alligator prenasalis*) Left tibia	Mus. Comp. Zool. 1014 Left fibula	Amer. Mus. 31822 (*Alligator mississippiensis*) Left tibia	Amer. Mus. 31822 Left fibula
Length total	116	98	144	148
Breadth proximal end	25	13	38	23
Breadth distal end	22	10	36	17
Circumference, minimum	35	23	69	41
Index, Circumference over length	301	235	469	277

Tarsus and Pes

The left astragalus of No. 1,015 is the only bone from the tarsal series that is completely preserved. Its form is indistinguishable from that of the astragalus of *Alligator mississippiensis*.

Maximum breadth. . . . . 24 mm.

A number of isolated bone nodules probably represent other tarsal or carpal bones incompletely preserved.

The pes is incomplete in both specimens. A composite from both 1,014 and 1,015 provides a right pes with the proximal phalanx of the first digit missing. All of this pes is No. 1,014 except the claw of Digit IV, which is No. 1,015. A composite left pes is less complete. A number of duplicate bones belonging to No. 1,015 have necessarily been omitted from the composite. The pes resembles that of *A. mississippiensis* very closely except that the whole structure is somewhat narrower in proportion to its length.

Vertebrae

A number of vertebrae are preserved in both 1,014 and 1,015. They overlap slightly with respect to position in the column, but for the most part occupy different places in the column. Seventeen

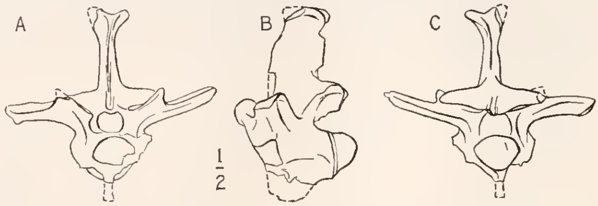


Fig. 7. *Alligator prenasalis* (Loomis). Vertebra, Dorsal 3; A, anterior view; B, lateral view, left side; C, posterior view. One-half natural size. Mus. Comp. Zoöl. No. 1,014.

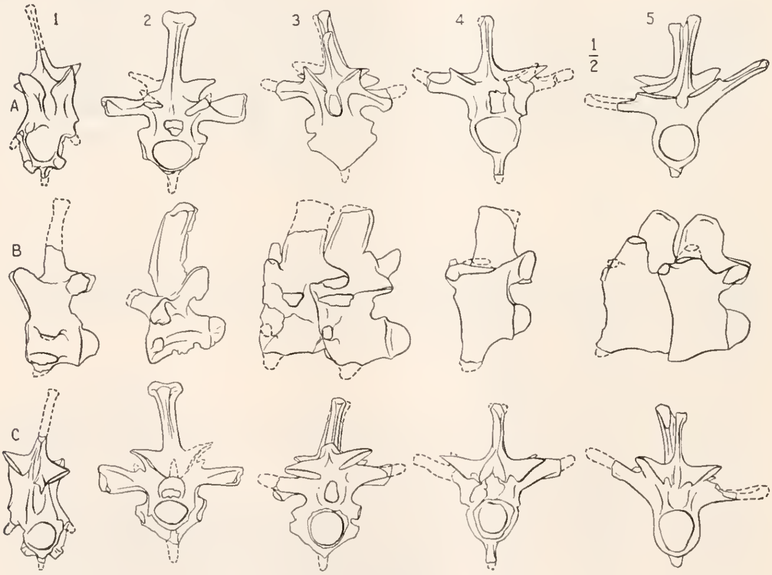


Fig. 8. *Alligator prenasalis* (Loomis). Vertebrae (1), Cervical 8; (2), Dorsal 1; (3), Dorsals 2, 3; (4), Dorsal 4; (5), Dorsals 5–6. A, Anterior views; B, lateral views, left side; C, posterior views. One-half natural size. Mus. Comp. Zoöl. No. 1,015, (1, 3, 4, 5); and No. 1,014, (2).

of the best preserved vertebrae have been selected for description and illustration. These range from Cervical to Caudal 4 as follows:

Cervicals	4, 5, 6	No. 1,014
Cervical	8	1,015
Dorsal	1	1,014
Dorsals	2, 3	1,015
Dorsal	3	1,014
Dorsal	4	1,015
Dorsals	5, 6	1,015
Dorsal	10?	1,014
Dorsal	11?	1,015
Lumbar	2	1,015
Lumbar	3	1,015
Caudal	1	1,015
Caudal	4	1,014

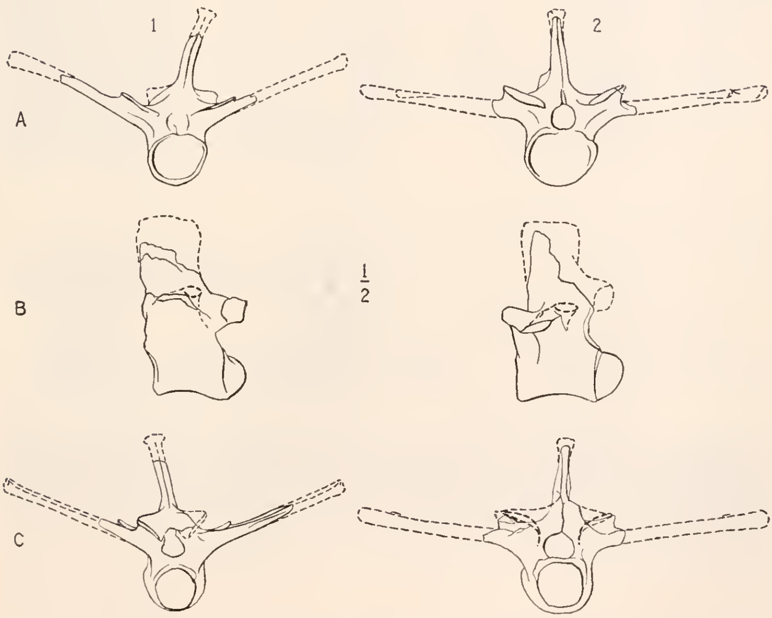


Fig. 9. *Alligator prenasalis* (Loomis). Vertebrae, (1), Dorsal 10; (2), probably Dorsal 11; A, anterior views; B, lateral views, left side; C, posterior views. One-half natural size. Mus. Comp. Zoöl. No. 1,014 (1) and 1,015 (2).

Other vertebrae are present in the lot, but are not sufficiently distinctive to warrant an attempt at accurate identification or description.

These vertebrae are normal alligatoroid vertebrae, and differ from those of the living Florida alligator in no essential characters.

Discrepancies in the measurements may be explained as due to differential distortion of the specimens.

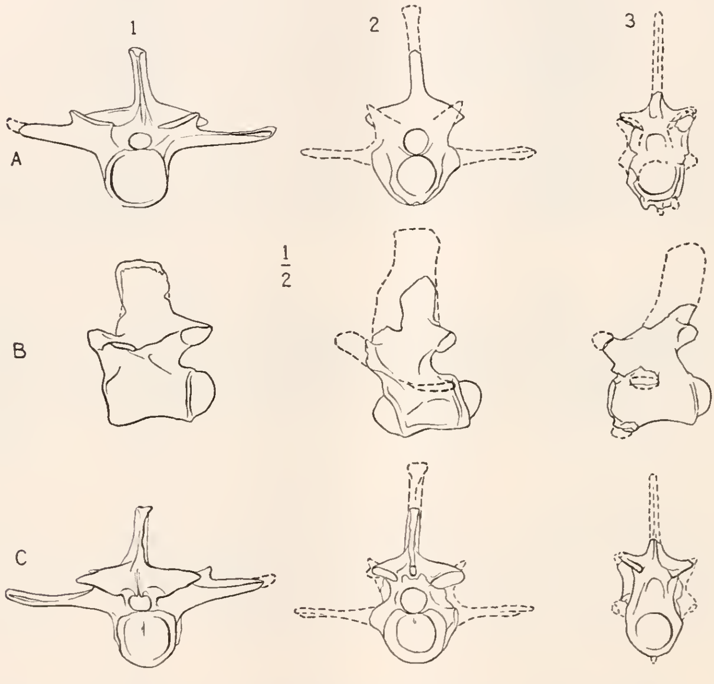


Fig. 10. *Alligator prenasalis* (Loomis). Vertebrae (1), Lumbar 2; (2), Caudal 1; (3), Caudal 4; A, anterior views; B, lateral views, left side; C, posterior views. One-half natural size. Mus. Comp. Zoöl. Nos. 1,014 (2) and 1,015 (1 and 3).

Measurements

	Length of centrum	Height, total	Breadth across prezygapophyses	Breadth across postzygapophyses	Breadth across transverse processes
Cervical 4.(1,014)	24 est.	44	24 est.	23 est.	28
Cervical 5.(1,014)	23 est.	44	24 est.	22 est.	30 es.t
Cervical 6.(1,014)	28	44	25 est.	—	33 est.
Cervical 8.(1,015)	26	55 est.	20	24	—
Dorsal 1.(1,014)	27	49 dist.	20 est.	26 est.	49
Dorsal 2.(1,015)	25	51 est.	19 dist.	25	44+
Dorsal 3.(1,015)	28	52	—	28	44+
Dorsal 3.(1,014)	28	48 est.	28	26	58
Dorsal 4.(1,015)	27	55	26 dist.	35	—
Dorsal 5.(1,015)	27	53	27	29	—
Dorsal 6.(1,015)	29	50	—	29	54 est.
Dorsal 10?(1,014)	26	48+est.	33	24 est.	70+
Dorsal 11?(1,015)	30	50 est.	33	—	—
Lumbar 2.(1,015)	28	43	33	33	76+
Lumbar 3.(1,015)	30	43	32 est.	34 est.	70+
Caudal 1.(1,015)	29	43 est.	—	24 dist.	—
Caudal 4.(1,014)	27	—	—	20	—

Ribs

A number of ribs are preserved, but they are not sufficiently distinctive to warrant special description.

Conclusions

Alligator prenasalis was originally described by Prof. F. B. Loomis in the American Journal of Science as *Crocodilus prenasalis*.[1]

It was based upon fragments of the snout and lower jaws in the Museum of the South Dakota School of Mines. Ten vertebrae, twenty-five dermal scutes, a femur, a tibia, an astragalus, and some fragments in the Museum of Amherst College were treated as paratypes. The type and paratype specimens were found six miles apart, near Fulsom Post Office, South Dakota, in the Titanotherium Beds of the White River Formation.

In 1916 Dr. M. G. Mehl[2] referred this species to his new genus

[1] Series 4, **18**, 1904, pp. 427–432, 11 figs.
[2] Journ. Geol., **24**, pp. 55, 56.

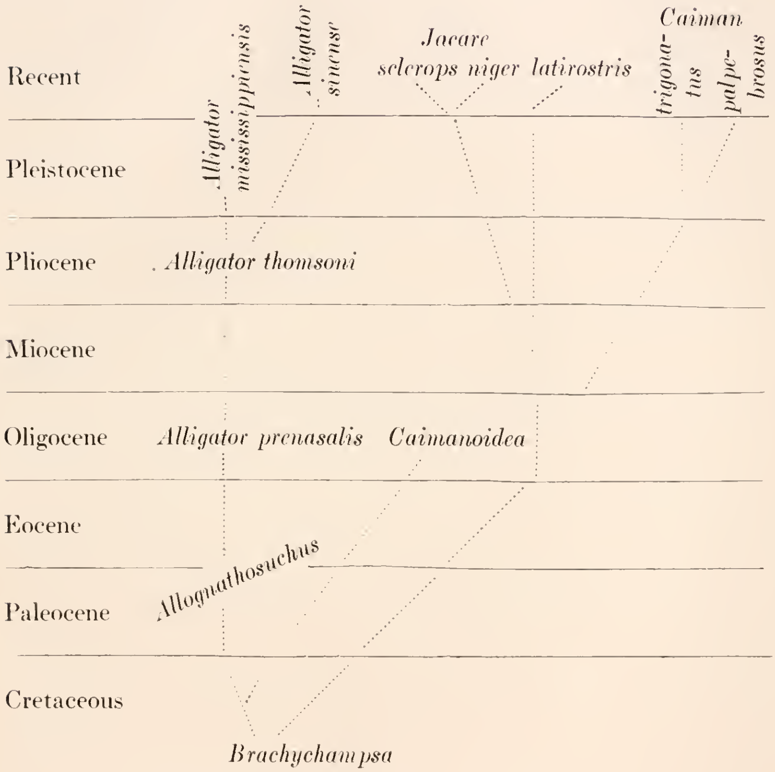
Caimanoidea, and in 1918 Dr. W. D. Matthew referred to it as *Alligator "Crocodilus" prenasalis*.[1]

This reference is correct, and the species stands as: *Alligator prenasalis* (Loomis).

The new specimens of the Museum of Comparative Zoölogy agree in characters with the type of *A. prenasalis* in so far as comparison is possible, except that the type snout is somewhat less broad. As the type is a smaller and younger specimen this difference is quite evidently due to age differentiation. The level of the new specimens is practically identical with that of the type, and the locality is not far from the type locality. We need have no hesitation in referring the specimens under consideration to *Alligator prenasalis*. The new material is so much more complete than the type that it permits a more detailed description of the osteology of the species than has heretofore been possible.

The characters of the skull especially, show the species to be a true alligator, that is, a member of the genus *Alligator* Cuvier. The region of the external narial aperture agrees with the type of *Caimanoidea visheri* of Mehl. The latter author separated *Caimanoidea* from *Alligator* partly on the characters of the narial aperture. In both species of *Alligator* now living the aperture is completely divided by a median septum. In *Jacare* and *Caiman* the aperture is not divided. In this respect *Caimanoidea* resembles *Jacare* and *Caiman* rather than *Alligator*. *Alligator thomsoni*, from the Snake Creek Beds, is intermediate in this respect between *Caimanoidea visheri* and the living alligators. It seems doubtful that this character is of generic value, and it is hardly sufficient ground, by itself, for separating *Caimanoidea* from *Alligator*. This does not affect the validity of *Caimanoidea*, as it is based on other characters as well. The material herein described also resembles the Paleocene and Eocene species that I have designated as *Allognathosuchus*, but its affinities are definitely closer to the living alligators than to the members of this genus. The genera *Alligator* Cuvier, *Caimanoidea* Mehl, and *Allognathosuchus* Mook, are closely related to each other. *Jacare* Gray and *Caiman* Spix exhibit resemblances to these three genera, but they are evidently largely the results of parallelism rather than of close relationship. *Brachychampsa* Gilmore, of the Cretaceous, may be ancestral to both the North American and South American phyla, as represented by *Allognathosuchus*, *Caimanoidea* and *Alligator* on the one hand and *Jacare* and *Caiman* on the other. A provisional interpretation of these relationships is indicated on p. 41.

[1] Amer. Mus. Journ. **18**. pp. 505, 506.


Recent
Pleistocene
Pliocene
Miocene
Oligocene
Eocene
Paleocene
Cretaceous
Alligator mississippiensis
Alligator sinense
Jacare
sclerops niger latirostris
Caiman
trigonatus
palpebrosus
Alligator thomsoni
Alligator prenasalis
Caimanoidea
Allognathosuchus
Brachychampsa

EXPLANATION OF PLATES

PLATE 1

PLATE 1

Alligator prenasalis (Loomis). Skull and jaws, superior view. One-half natural size. Mus. Comp. Zoöl. No. 1,014.

HELIOTYPE CO. BOSTON

PLATE 2

PLATE **2**

Alligator prenasalis (Loomis). Skull and jaws, palatal view. One-half natural size. Mus. Comp. Zoöl. No. 1,014.

HELIOTYPE CO. BOSTON

PLATE 3

PLATE 3

Alligator prenasalis (Loomis). Skull and jaws, lateral view, left side. One-half natural size. Mus. Comp. Zoöl. No. 1,014.

HELIOTYPE CO. BOSTON

Bulletin of the Museum of Comparative Zoölogy
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Vol. LXXIV, No. 3

ON CERTAIN SIMILARITIES BETWEEN SLOTHS AND SLOW LEMURS

By William L. Straus, Jr. and George B. Wislocki

[From the Departments of Anatomy, Johns Hopkins University and Harvard University]

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PRINTED FOR THE MUSEUM
September, 1932

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OF THE

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AT HARVARD COLLEGE

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No. 3.—*On Certain Similarities between Sloths and Slow Lemurs*

By William L. Straus, Jr. and George B. Wislocki

[From the Departments of Anatomy, Johns Hopkins University
and Harvard University]

Introduction

In a previous paper the present authors dealt with the blood vascular plexuses found in the extremities of certain mammals (Wislocki and Straus, 1932). During our investigations we emphasized that the particular type of plexus or rete mirabile which we designated "blood vascular bundle" was peculiar to certain of the edentates (sloths, didactyl and tetradactyl ant-eaters, pangolin) and to the lorisine or slow lemurs (*Nycticebus, Loris, Perodicticus*). We interpreted the vascular bundle type of plexus in the extremities as an example of structural convergence in two remotely related groups of mammals. Common to these groups also appeared to be a certain resemblance in their modes of living: namely arboreal life, sluggishness and a characteristic use of the extremities for the maintenance of clinging postures. It seemed of interest to investigate the general problem of whether these two groups of animals possess other structural peculiarities which might be interpreted as convergences relating to their habitual postures and modes of progression. These further investigations have been concerned with the proportions and certain skeletal characters of trunk and limbs, because it is in these relationships especially that one might expect to find the most pronounced expression of convergent adaptations in the groups of animals under consideration. Briefly it may be stated that we believe we have found data indicative of convergences between lorisine lemurs and the arboreal Xenarthra. These data we shall present and discuss.

Material

For the present investigation we have a large series of individuals and genera of both Xenarthra and Prosimiae at our disposal, as is shown in Tables 1 to 7. The data used herein are based, as indicated, not only upon new and unpublished observations, but also in part upon the literature.

We are indebted to Mr. Gerrit S. Miller, Jr. of the U. S. National Museum, Dr. T. Wingate Todd of Western Reserve University, and

Dr. William K. Gregory and Mr. H. E. Anthony of the American Museum of Natural History for the opportunity of studying specimens. We likewise wish to thank our colleague, Dr. Adolph H. Schultz, who has generously permitted us to make use of some of his unpublished measurements of the limbs and trunk of prosimians and sloths.

Observations and Discussion

Proportions of the extremities. One of the most striking characteristics of the sloths is the unusual length of the upper extremity, which surpasses that of the lower extremity.[1] As can be seen in Table 1, this disproportion is not nearly so marked in the two-toed sloth (*Choloepus*) as in the three-toed sloth (*Bradypus*). It will also be noted that in none of the other Xenarthra, either arboreal or terrestrial, is the fore-limb as long as the hind-limb.

From the conditions in such ground-living members of the order as the armadillos, *Dasypus* and *Cabassous*, we may conclude that a relatively short fore-limb is probably the primitive edentate condition. Thus the relatively great length of the upper extremity in *Bradypus* appears as a specialization, an adaptation to its sluggish, clinging arboreal mode of life. *Choloepus* has developed in the same direction, but without such extreme specialization.

An explanation of the relatively shorter upper extremities of the two ant-eaters, both extremely arboreal, may perhaps be found in their possession of long, prehensile tails. Both of the sloths, on the other hand, have extremely reduced tails, of no possible use for prehension. *Cyclopes* and *Tamandua* have thus adapted themselves to arboreal life in a different manner than have the sloths. This adaptation of the didactyl and tetradactyl ant-eaters has involved the development of long tails for grasping, whereas in the sloths the tail has become vestigial, and the upper extremity greatly lengthened.[2] In relative length of upper extremity *Tamandua* more closely approaches *Choloepus* than does *Cyclopes*.

Table 1 also reveals the fact that the Lorisinae, the group of lemurs including the genera *Nycticebus*, *Loris* and *Perodicticus*, whose mode of

[1] In this study, upper extremity (or fore-limb) has been regarded as consisting of humerus and radius alone, lower extremity (or hind-limb) of femur and tibia. Lengths of hand and foot have not been considered, since inclusion of these differently specialized distal segments in comparing the limbs of members of such widely separated orders as Edentata and Primates might lead to erroneous conclusions.

[2] *Cyclopes* possesses 40 or 41 caudal vertebrae, *Tamandua* 35 or 37 (Flower, Giebel). *Bradypus* has on the average only 10 (8–12) caudal vertebrae, *Choloepus* but 5 (4–6) (from specimens listed by Bateson, Flower and Giebel, and from our own observations on 2 skeletons of *Bradypus*). In other Xenarthra the conditions are intermediate, the number of caudal vertebrae varying from 11 to 12 in *Tolypeutes* to 29 in *Myrmecophaga* and 31 in a *Dasypus novemcinctus* (Flower, Giebel).

life approximates that of the sloths (Wislocki and Straus, 1932), exhibit specializations similar to those of the Bradypodidae in respect to length of limbs. In all of the other lemurs, including the fossil Eocene genus *Notharctus*, humerus and radius together are less than three-quarters the length of combined femur and tibia. This we may accept as approximating the primitive lemurine condition. Only in the

TABLE 1

	Number of specimens	Intermembral index $\frac{\text{Humerus} + \text{radius}}{\text{Femur} + \text{tibia}} \times 100$
Tarsius (Schultz)	7	54.2(50.4–57.1)
Tarsius	1	57.9
Daubentonia	1	70.9
Microcebus	1	70.9
Chirogale (Mollison)	1	70.0
Galago (Schultz)	7	66.4(58.9–72.5)
Galago	2	59.0(53.1 and 64.8)
Lemur (Schultz)	2	72.2(71.3 and 73.1)
Lemur	2	71.4(71.2 and 71.6)
Lepidolemur	1	62.9
Lichanotus	1	55.7
Propithecus (Mollison)	2	64.0(63.0 and 65.0)
Indris (Mollison)	3	62.0(61.0–63.0)
Perodicticus (Schultz)	1	88.3
Perodicticus	1	90.4
Nycticebus (Schultz)	3	92.3(90.4–94.5)
Loris (Mollison)	7	90.0(82.0–94.0)
Notharctus†	1	61.9
Cabassous	1	68.6
Dasypus	1	64.6
Myrmecophaga	1	86.4
Tamandua	1	90.8
Cyclopes	1	61.8
Choloepus	3	112.2(107.4–117.1)
Bradypus (Schultz)	3	175.0(171.5–178.4)
Bradypus	2	172.3(171.3 and 173.3)

TABLE 1. Intermembral indices of *Prosimiae* and *Xenarthra*. All measurements figuring in this table and Tables 2 and 3 have been taken according to the methods outlined by Schultz (1929). The indices taken from Schultz have been calculated by us from measurements hitherto unpublished.

Lorisinae does the upper extremity approach the lower extremity in length. It thus becomes apparent that the relatively great length of the upper extremity in the lorisine lemurs is a definite specialization, probably an adaptation to their sluggish life, peculiar to them among the lemurs. Similarly, the reduced number of caudal vertebrae in the slow lemurs indicates that this adaptation has paralleled that of the sloths rather than that of the ant-eaters.[1] *Notharctus* possessed a long tail (Gregory, 1920), and so do most of the existing Lemuroidea. Exceptions such as *Indris* are best regarded as parallelisms of the Lorisinae produced by unknown factors.

The differences in the extremities of the various animals are most apparent in Table 2. Here the extremities are compared with the

TABLE 2

	Number of specimens	$\frac{\text{Humerus + radius}}{\text{anterior trunk height}} \times 100$	$\frac{\text{Femur + tibia}}{\text{anterior trunk height}} \times 100$
Lemur (Schultz)	2	69.8(67.2 & 72.3)	96.6(94.2 & 98.9)
Perodicticus (Schultz)	1	75.7	85.7
Nycticebus (Schultz)	3	77.9(72.5-81.9)	84.5(78.9-90.6)
Choloepus	1	103.9	96.8
Bradypus	1	154.4	88.2

TABLE 2. Upper and lower extremities in percentage of anterior trunk height in *Prosimiae* and *Xenarthra*. The measurements of the limbs of the specimen of *Bradypus* were taken by Dr. A. H. Schultz, the trunk height by one of the present writers.

trunk height. It is seen that two factors contribute to the differences between the intermembral indices of the sloths, i.e. the upper extremity of *Bradypus* is not only relatively longer than that of *Choloepus*, but the lower extremity is shorter. The same differences are noted when comparing *Perodicticus* and *Nycticebus* with *Lemur*. This analysis of limb length emphasizes the convergence between the sloths and the lorises. It indicates that in their adaptations to a clinging sluggish mode of life the limbs have undergone similar specialization in the two groups.

[1] The not clearly separable genera, *Nycticebus*, *Loris* and *Stenops*, when considered together, possess, on an average, 9 (5-12) caudal vertebrae; *Perodicticus* 14 (9–20). In other lemurs the number ranges from 9 or 11 in *Indris* to as many as 28 in individual specimens of *Microcebus* *Lemur*, *Lepidolemur*, *Myoxicebus* and *Propithecus*. Giebel reports as many as 32 in one *Tarsius*.

The shape of the thorax. Next to the extremities, we might expect the trunk to exhibit evidences of adaptive convergence, especially in the thoracic region. In a typical quadruped, such as the dog, the chest is narrow and deep, the greatest dimension being in the ant.-post. diameter. This is the condition in most of the Lemuroidea, the chest index being below 100 (see Table 3). In the prosimians, however, the discrepancy between thoracic breadth and depth is not so marked as in such an animal as the dog. Indeed, in *Tarsius,* which is in no sense quadrupedal but which progresses by leaping in frog-like fashion and in an upright position, the breadth of the chest occasionally surpasses

TABLE 3

	Chest index *Number of Specimens*	$\frac{\text{chest breadth}}{\text{chest depth}} \times 100$
Canis (Jackson)	1	74.5
Tarsius (Schultz)	7	90.9(83.9–102.0)
Tarsius	1	91.2
Galago (Schultz)	7	89.3(85.5–95.5)
Lemur (Schultz)	2	94.2(91.7–96.6)
Perodicticus (Schultz)	1	109.1
Nycticebus (Schultz)	3	104.6(100.0–111.6)
Choloepus	1	128.6
Bradypus (Schultz)	2	157.7(155.6 and 159.7)

TABLE 3. Chest indices of *Canis, Prosimiae* and *Xenarthra.*

the depth. In both *Nycticebus* and *Perodicticus* the chest is relatively broader than in other lemurine forms. Herein they surpass even *Tarsius,* for their chest indices are always 100 or above, breadth of thorax normally exceeding the depth. Similarly, in both genera of the Bradypodidae the chest indices are very high. In these animals the thorax is indeed relatively much broader than in the slow lemurs.

The experiments of Jackson (1907) upon dogs, and the ontogenetic studies by Schultz (1926) on *Bradypus,* suggest that the adult shape of the thorax (as expressed by the chest index) is influenced, at least to some degree, by the habitual posture of the animal. This means nothing more than that the resultant force of gravity upon the thoracic viscera is transmitted to and influences the development of the sur-

rounding bony cage. It is not surprising, therefore, to find that the chests of the sloths are relatively broader than those of typical quadrupeds. It is likewise significant that the broadening of the thorax is more extreme in *Bradypus*, which spends more of its time in a perpendicular position than does *Choloepus* (Wislocki, 1928). Of the lemurs, only the lorises assume protracted clinging postures. Thus it is interesting that they exhibit a greater thoracic broadening than do the

TABLE 4

Number of Presacral Vertebrae

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Chlamydophorus	..	1													
Priodontes	...	2													
Cabassous	...	..	2												
Tolypeutes	...	1	1												
Tatusia	1	5	..	1											
Dasypus	...	4	3	1											
Myrmecophaga	...	...	..	.	.	3									
Tamandua	...	..	..	..	..	.	1	3	1						
Cyclopes	...	..	..	..	1	3									
Bradypus	...	..	..	..	..	..	7	28	22	1					
Choloepus	...	..	..	..	..		...	...	..	...	1	6	3	9	5

Table 4. Distribution of specimens of *Xenarthra* with regard to the total number of presacral vertebrae. Based on data taken from Giebel (original observations), from Flower and from Bateson, and supplemented by the authors' own observations on the following specimens: 1 *Cabassous*, 2 *Dasypus*, 2 *Cyclopes*, 2 *Bradypus*, 2 *Choloepus*. The generic names given by Giebel (1874) and by Flower (1884) have been changed to agree with the nomenclature used by Palmer (1904) and Miller (1924), and have been included in this table and in Table 6 in their revised forms.

other Lemuroidea. Yet in this character, as in the relative lengths of the limbs, their specializations by no means appear to be as extreme as those of *Bradypus* and *Choloepus*. These observations lend support to the theory that habitual postures influence the shape of the thorax. They are also suggestive of an adaptive convergence between Lorisinae and Bradypodidae.

The number of the presacral vertebrae. Another interesting feature concerns the number of the presacral vertebrae (see Tables 4 and 5).

In the terrestrial Xenarthra the number of presacral segments ranges from 20 to 25. This number shows a general increase in the arboreal members of the group: 24 or 25 in *Cyclopes*, 26 to 28 in *Tamandua*, 26 to 29 in *Bradypus*, and 30 to 34 in *Choloepus*. Since there is evidence that the primitive mammalian number of presacral vertebra was 26 (Todd, 1922), it follows that in the recent terrestrial Xenarthra the

TABLE 5

NUMBER OF PRESACRAL VERTEBRAE

	25	26	27	28	29	29½	30	31
Tarsius	....	14	4					
Daubentonia	1	7						
Galago	....	12	2					
Chirogale	....	....	1					
Microcebus	....	....	2					
Lepidolemur	....	....	....	2				
Myoxicebus	2							
Lemur	5	33	4					
Lichanotus	....	....	3	1				
Propithecus	....	....	1					
Indris	....	....	....	3	....	....	....	....
Perodicticus	....	....	2	1	1	...	3	....
Nycticebus-Loris	....	....	....	....	3	1	21	9

TABLE 5. Distribution of specimens of *Prosimiae* with regard to the total number of presacral vertebrae. Based on data taken from the literature and from the authors' own observations of the following specimens: 3 *Tarsius*, 8 *Galago*, 1 *Chirogale*, 1 *Microcebus*, 1 *Lepidolemur*, 1 *Myoxicebus*, 16 *Lemur*, 3 *Perodicticus*, 8 *Nycticebus-Loris*. Information regarding the number of cervical vertebrae of some specimens was not available; but in view of the extreme numerical constancy of this series in primates, it has been deemed justifiable to assume their number as being seven in all such instances.

trunk has become shortened, the pelvis migrating cranially. The opposite has occurred among some of the arboreal members of this group, at least to a marked degree in one representative, *Choloepus*. Similarly, among the Lemuroidea, we can observe two trends in respect to the number of presacral vertebrae. Some lemurs have retained, on an average, the theoretical primitive number of 26. *Myoxicebus* and occasional individuals of other genera have slightly shortened the presacral column. Yet the tendency, in general, has been towards a

lengthening (see also Todd). This lengthening, or increase of presacrals, is most marked in *Nycticebus*, *Loris* and *Perodicticus*. The former are on the whole more advanced in this respect than is *Perodicticus*. This increase of presacral segments in the lorises and the arboreal Xenarthra may be interpreted as a convergence.

The number of ribs. Coincident with its greater number of presacral vertebrae, *Choloepus* exhibits more pairs of ribs than do any of the other Xenarthra (see Table 6). Similarly, the arboreal Xenarthra

TABLE 6

NUMBER OF PAIRS OF RIBS

	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Chlamydophorus	...	...	1													
Priodontes	...	...	...	1	1											
Cabassous	...	...	...	2												
Tolypeutes	...	...	2													
Tatusia	2	...	5													
Dasypus	1	3	4													
Myrmecophaga	...	...	...	...	...	...	2	2								
Tamandua	...	...	...	...	...	...	...	...	2	3						
Cyclopes	...	...	...	...	...	...	1	3								
Bradypus	...	...	...	...	1	11	31	1								
Choloepus	...	...	...	...	...	...	...	...	...	...	...	...	1	4	7	3

TABLE 6. Distribution of specimens of *Xenarthra* with regard to the number of pairs of ribs. Based on data taken from Giebel, from Flower and from Bateson, and from the authors' observations on the specimens listed in Table 4 and on an additional skeleton of *Myrmecophaga*.

possess more ribs than do the terrestrial, *Myrmecophaga* standing out as the sole exception to the rule. The same difference exists when the slow lemurs are contrasted with the other Lemuroidea, for the Lorisinae exhibit more ribs than do any of the remaining lemurs (see Table 7). The presence of a large number of ribs, as in *Choloepus*, could be regarded as an adaptive specialization associated with the need for an effective armature for a slow-moving animal, were it not for the fact that *Bradypus* normally possesses no more ribs than does the more active terrestrial *Myrmecophaga*. Even when we consider that the eighth and ninth vertebral segments of *Bradypus* seem to have lost their ribs and become incorporated into the neck, the caudal extension

of the thorax by no means approaches that of *Choloepus*. Yet the tridactyl sloth is actually more sluggish than the didactyl sloth. Undoubtedly other factors come into play in the production of a long thorax.

The character of the processi spinosi. In addition to numerical vertebral convergence, there are some interesting points which relate to the arrangements of the processi spinosi. It is well known that the spinous processes of the vertebrae in typical active quadrupedal mammals slope in two directions. The more cranial spines are retroverted and the more caudal anteverted toward an intermediate erect or anticlinal spine. This anticlinal vertebra is situated near the caudal end of the thorax. This point is often referred to as the "center of motion."

TABLE 7

NUMBER OF PAIRS OF RIBS

	11	12	13	14	15	16	17	18
Tarsius	....	1	16	1				
Daubentonia	....	3	4					
Galago	....	....	11	2				
Chirogale	....	....	3					
Microcebus	....	....	....	1				
Lepidolemur	....	1						
Myoxicebus	1	1						
Lemur	....	28	11					
Lichanotus	....	3	1					
Propithecus	....	1						
Indris	....	1	1					
Perodicticus	....	....	....	1	3	3		
Nycticebus-Loris	....	....	....	5	10	14	2	1

TABLE 7. Distribution of specimens of *Prosimiae* with regard to the number of pairs of ribs. Based on data taken from the literature and from the authors' own observations on the specimens listed in Table 5.

In all of the Xenarthra which we examined, both arboreal (*Bradypus*, *Choloepus*) and terrestrial (*Cabassous*, *Dasypus*, *Myrmecophaga*), we have found no anticlinal spine. All of the presacral spines are directed back to the sacrum. In the slow lemurs, *Nycticebus* and *Perodicticus*, the slope of the spinous processes is as in the Xenarthra. Other

lemurs, such as *Galago* and *Lemur*, possess, on the contrary, an anticlinal spine, the processi spinosi being arranged in two sloping series.

Wood Jones (1918) has dealt with this feature of the vertebral column at some length. According to him, uniform retroversion of the presacral spinous processes is apparently the primitive mammalian condition. The Bradypodidae, according to him, appear to have been derived from a lumbering terrestrial stock, likewise possessing uniform spinous retroversion. The recent sloths, as well as the other Xenarthra under consideration, appear therefore to have retained the ancestral slope of the spinous processes. The same reasoning is not applicable to the Lorisinae, because the ancestors of the slow lemurs were almost certainly active animals, in all likelihood possessing vertebral spines sloping in two series towards an intermediate anticlinal spine (also see Wood Jones). From what Gregory (1920) says of the similarity of the vertebral column of the Eocene genus *Notharctus* to that of the modern *Lemur* it is to be presumed that this fossil possessed an anticlinal spine. This merely bears out other evidence indicating a dual slope of the spines in the ancestors of *Nycticebus* and *Perodicticus*. Thus in the lorises the uniform retroversion of the spinous processes, and the consequent absence of an anticlinal spine, appears to be a specialization, rather than a persistence of a primitive ancestral condition. It may be interpreted as a convergence in the direction of the Bradypodidae.

In the Bradypodidae the spines of the lower thoracic and of the lumbar vertebrae are characteristically low and blunted, the cervical and upper thoracic spines longer and more pointed. Essentially the same conditions obtain in the Lorisinae, but here the blunting is not so marked. This is illustrated by examining *Nycticebus* or *Perodicticus*. In *Nycticebus* the processi spinosi of all of the cervical and the upper thoracic vertebrae are rather long and well developed. Towards the lowermost part of the thorax the spinous processes become lower and blunter, a condition most pronounced in the proximal lumbar segments. Practically identical arrangements occur in *Perodicticus*, but in this animal the cervical and uppermost thoracic spines are unusually long and pointed, much more so than in *Nycticebus*. In the more active members of their respective orders, such as *Dasypus* among the Xenarthra, and *Galago* and *Lemur* among the Lemuroidea, an entirely different condition prevails. The thoracic and lumbar spines are prominent and relatively slender, while the cervical spines, excepting that of the epistropheus, are short and sometimes practically nonexistent. It seems probable that here again in sloths and lorises we

are dealing with the phenomenon of convergence. The relatively low, blunted thoracico-lumbar spines of the sloths and slow lemurs are possibly correlated with back musculature more adapted to the gross purpose of strength and support than to the finer movements concerned with agility. The relatively greater development of the spinous processes of the cervical vertebrae may in turn be related to the development of the back musculature in this region. But naturally extended observations on the back musculature of these and related types would be necessary to prove this assumption, which is offered here merely as a suggestion.

Conclusions

It is obvious that the sloths and lorises exhibit marked similarities in certain morphological characters. These similarities are apparently correlated with functional similarities of the parts involved. They are by no means indicative of any close genetic relationship of the two groups, but may be regarded as adaptive convergences. The sloths are plainly highly and peculiarly specialized members of the Xenarthra, while the slow lemurs occupy a similar position among the Lemuroidea.[1] Both groups have secondarily become adapted to a sluggish mode of arboreal life, and to the maintenance of clinging postures. Therein seems to lie the answer to the convergent structural adaptations. These structural similarities, which we interpret as convergences, involve the presence in the extremities of a peculiar and highly specialized type of blood vascular distribution (the bundle form of rete mirabile); increase in relative length of the upper extremity; reduction of the tail; relative broadening of the chest; increase in number of presacral vertebrae and ribs; absence of an anticlinal vertebra;[2] and blunting of thoraco-lumbar and lengthening of cervical spinous processes.

[1] The two-toed and three-toed sloths differ markedly from one another, as is obvious from the characters under consideration (also see Wislocki, 1928). This is an interesting point, but it lies outside the scope of this paper.

[2] Since this paper went to press one of us (W. L. S.) has had the opportunity of examining two skeletons of *Loris tardigradus tardigradus* recently acquired by the U. S. National Museum. In each of these skeletons an anticlinal vertebra was clearly manifested. *Loris* thus appears to differ from both *Nycticebus* and *Perodicticus* in respect to the slope of the vertebral spines, and in this character would seem to be more primitive than the other slow lemurs. It is possible, however, that this particular feature of the vertebral column may be subject to individual variation, even within a single genus.

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CONTENTS

	Page
Introduction	59
Fishes	60
Reptiles and Amphibians	95
Birds	99

Introduction

Ordinarily catalogues of this sort make mention of only primary types, as supplementary types are generally considered to be of slight importance. In paleontology it frequently happens that primary type material is poorly preserved or fragmentary. Subsequent collections may include better examples and may illustrate the species more successfully than the original specimens. A case in point is that of *Cymbospondylus petrinus* Leidy, which was described from three fragmentary vertebrae. Later Merriam published extremely detailed accounts of this species, based on practically complete skeletons. These are mere plesiotypes, but are far more instructive than the holotype. On account of instances of this nature, all recognizably mentioned or figured specimens are included in this catalogue. Cf. Cushman, Proc. Boston Soc. Nat. Hist., **33**, No. 6, 1907, p. 249.

The accepted terminology of the primary types has been followed (holotype, cotype, paratype, etc., with the prefix "geno-" to indicate original material of a type species); for supplementary types the single term "plesiotype" has been used. Many have objected to this term as being too general to be of much definite use, but, as Schuchert says (Bull. U. S. Nat. Mus., **53**, Pt. 1, 1905, p. 12), one "fails to see what can be gained by dividing these supplementary types into different categories. After all, it is the primary types on which the taxonomy rests, and the supplementary types (plesiotypes) simply help to elucidate the original material." Accordingly, such an elaborate system as that recommended by the Geological Society of America's Special Committee on the Marking of Type Specimens (Bull. Geol. Soc. Amer.,

40, No. 1, 1929, pp. 215–220) has not been adopted; there, for example, are enumerated (op. cit., p. 219) five different kinds of supplementary (published) types, all of which are included in "plesiotype" as used in this catalogue.

The types are listed alphabetically by genera, as far as the published references will permit, and are grouped under three headings: Fishes, Reptiles and Amphibians, and Birds. To save space by avoiding a certain amount of repetition, references to the literature are concentrated in a bibliography at the end of the catalogue, arranged chronologically under the authors, who appear in alphabetical order. An exception is made for Agassiz's Poissons Fossiles, on account of the numerous variously dated fascicles in which the work was issued; each reference to this is given in full.

In addition to the specimens listed on the following pages, the museum contains many of the selachian teeth described by St. John and Worthen in volumes **6** and **7** (1875 and 1883) of the Palaeontology of Illinois. These are for the most part in the Wachsmuth Collection, although some were obtained through Orestes St. John, and a few from other sources. They are not listed individually because of the difficulty in identifying the actual types, when not especially labeled by the authors, from among large series of similar, specifically identical teeth; at best one can be certain, in such cases, only of the particular lot in which is the type.

FISHES

Acanthaspis armata Newberry

5097. Plesiotype. Columbus limestone. Sandusky, Ohio. Coll. H. Herzer, 1898. Eastman, 1907b, p. 117, pl. II, fig. 2; 1908, p. 145, pl. I, fig. 14.

This individual is now *Acanthaspis newberryi* Heintz. Holotype. Heintz, 1929~~a~~, p. 72, fig. 35.

Acantholepis fragilis Newberry

5101. Plesiotype. Eastman, 1908, pp. 141–142, pl. III, figs. 5, 5a. See Eczematolepis fragilis (Newberry).

Acanthopterygian, gen. et sp. ind.

5067. Nilsson, 1824, p. 103, pl. II, fig. 1. See Semionotus nilssoni Agassiz.

ACANTHURUS OVALIS Agassiz

5264 (Orig. No. 10). Plesiotype. Eocene. Monte Bolca, near Verona, Italy. Coll. Canossa, through Krantz, 1903. Volta, 1796, pp. 270-271, pl. LXV, fig. 1, as *Chaetodon canus* Seba, *errore*; Agassiz, 1835, 1835a, and Poiss. Foss., **4**, p. 16* (1838), p. 253 (1842), as *Pygaeus nobilis* Agassiz, *errore* (Agassiz never saw the specimen, and made his identification from Volta's poor figure).

ANACLITACANTHUS SEMICOSTATUS St. John and Worthen

5187. Genoholotype. St. John and Worthen, 1875, p. 443, pl. XVI, figs. 14a-c.
See CTENACANTHUS SEMICOSTATUS (St. John and Worthen).

APEDODUS PRISCUS Leidy

5116, 5117. 2 plesiotypes. Chemung. Warren, Pa. Eastman, 1907b, p. 166, pl. I, figs. 1, 2.

ARTHRODIRE, gen. et sp. ind.

5237 Plesiotype. Base of Waverly. Boyle County, Ky. Moritz Fischer leg., 1907. Dorsomedian. Eastman, 1908, fig. 32, p. 206.

ASTEROLEPIS sp.

5079. Hussakof, 1906, p. 130, fig. 13c.
See ASTEROLEPIS MAXIMA Agassiz.

ASTEROLEPIS MAXIMA Agassiz

5079. Plesiotype. Upper Old Red. Nairnshire, Scotland. Eastman, 1904b, p. 256, fig. 3, as *Bothriolepis major* (Agassiz); Hussakof, 1906, p. 130, fig. 13c, as *Asterolepis sp.*; Eastman, 1907b, pp. 53-54.
5081. Plesiotype. Upper Old Red. Nairnshire, Scotland. Eastman, 1904b, p. 255, fig. 2, as *Bothriolepis major* (Agassiz); 1907b, pp. 53-54.

BELEMNACANTHUS GIGANTEUS Eastman

5080 (formerly M.C.Z. 3091). Genoholotype. Mid-Devonian. Kerpen, Eifel, Germany. Coll. Schultze, 1871. Eastman, 1898, pp. 552-556, fig. 50, p. 553.

BELONORHYNCHUS DAYI Raymond

1564. Holotype. Spray River shale. Massive Siding, Alberta. Joseph P. Day, Jr leg. and don., 1924. Raymond, 1925, pp. 551–554, fig. 1, p. 552 (text refers to 1654, *errore*).

BIRKENIA ELEGANS Traquair

1569, 1573. Two plesiotypes. Downtonian. Seggholm, Ayrshire, Scotland. D. Tait and H. C. Stetson leg., 1926. Stetson, 1928a, fig. 5, p. 465, and fig. 2, p. 461.

2006, 2007. Plesiotypes. Downtonian. Seggholm, Ayrshire. H. M. Geol. Surv. leg., 1927. Stetson, 1928a, fig. 1, p. 460, fig. 3, p. 463, and fig. 6, p. 467.

BOTHRIOLEPIS CANADENSIS Whiteaves

5241 ~~5421~~ Plesiotype. Devonian. Scaumenac, Quebec. Stetson, 1930, p. 29, pl. VI, fig. 1.

BOTHRIOLEPIS MAJOR (Agassiz)

5079, 5081. Plesiotypes. Eastman, 1904b, fig. 3, p. 256, fig. 2, p. 255.

See ASTEROLEPIS MAXIMA Agassiz.

CAMPODUS VARIABILIS (Newberry and Worthen)

749. Plesiotype. Pennsylvanian. Osage County, Kans. Coll. G. C. Merrill. Eastman, 1902b, pp. 59 ff, fig. 2, p. 64, pl. II, pl. III, fig. 1.

CAMPYLOPRION ANNECTANS Eastman

2039. Genoholotype. Eastman, 1902a, p. 151, fig. 3, p. 152, pl. VIII, fig. 2; also p. 332.

See HELICOPRION ANNECTANS (Eastman).

CARANX PRIMAEVUS Eastman

5070. Holotype. Eocene. Monte Bolca, near Verona, Italy. Coll. Krantz, 1903. Eastman, 1904, pp. 28–29, fig. B, pl. I, fig. 4.

CARCHARIAS (Prionodon) sp. ind.

5146, 5147, 5148. Four teeth. Pacific red clay. ALBATROSS

fig. 4, Station 3681. Eastman, 1903a, p. 188, pl. I, figs. 1–4.

5149. Two teeth. Pacific red clay. ALBATROSS Station 3683. Eastman, 1903a, p. 188, pl. I, figs. 5, 6.

CARCHARIAS MEGALODON Agassiz

5074. Cotype. Agassiz, Poiss. Foss., **3**, pl. XXIX, figs. 6, 6a (1835).
See CARCHARODON MEGALODON Agassiz.

CARCHARIAS SULCIDENS Agassiz

5075. Two cotypes. Agassiz, Poiss. Foss., **3**, pl. XXXa, figs. 5, 5^1, 6, 6^1 (1838).
See CARCHARODON RONDELETII Müller and Henle.

CARCHARODON LANCIFORMIS Gibbes

5163. Three plesiotypes. Pacific dark brown clay. ALBATROSS Station 4685. Eastman, 1906a, pp. 80, 82, pl. II, figs. 13, 19, 22.
5165. Plesiotype. Pacific fine green mud. ALBATROSS Station 4656. Eastman, 1906a, pp. 80, 82, pl. II, fig. 21.
5166. Plesiotype. Pacific globigerina ooze. ALBATROSS Station 4732. Eastman, 1906a, pp. 81, 82, pl. II, fig. 20.

CARCHARODON MEGALODON Agassiz

5074. Cotype. Miocene? Styria. Coll. Bronn. 1859. Agassiz, Poiss. Foss., **3**, p. 249 (1843), pl. XXIX, figs. 6, 6a (1835). Referred to Carcharias on the plate.
5144. Three plesiotypes. Pacific red clay. ALBATROSS Station 3691. Eastman, 1903a, p. 187, pl. II, figs. 31–33.
5157. Three plesiotypes. Pacific red clay. ALBATROSS Station 3681. Eastman, 1903a, p. 186, pl. I, figs. 21–23.
5167. Plesiotype. Pacific globigerina ooze. ALBATROSS Station 4740. Eastman, 1906a, p. 82, pl. II, fig. 23.
5265. Plesiotype. Tertiary. Arica, Chile. A. E. Douglass leg. and don. Eastman, 1903a, p. 187.

CARCHARODON RONDELETII Müller and Henle

5075. Two plesiotypes (cotypes of *C. sulcidens* Agassiz). Pliocene. Castel – Arquato, Italy. Agassiz, Poiss. Foss., **3**, p. 254 (1843), pl. XXXa, figs. 5, 5^1, 6, 6^1 (1838), as *C. sulcidens* Agassiz (Carcharias in legend on plate).

Carcharodon sulcidens Agassiz

5075. Two cotypes. Agassiz, Poiss. Foss., 3, p. 254 (1843).
See Carcharodon rondeletii Müller and Henle.

Catopterus gracilis J. H. Redfield

5068 (formerly M.C.Z. 2531). Plesiotype. Eastman, 1905, pl. XIII, *errore.*
See Dictyopyge macrura (W. C. Redfield).

Chaetodon canus Seba

5264. Plesiotype. Volta, 1796, pp. 270–271, pl. LXV, fig. 1, *errore.*
See Acanthurus ovalis Agassiz.

Chimaeroid (?) dermal plate

5119. Eastman, 1908, p. 149, pl. II, fig. 15.
See under Elasmobranch.

Chimaeroid (?) dermal tubercle

5118. Kinderhook limestone. Burlington, Iowa. Coll. O. H. St. John, 1873. Eastman, 1908, p. 149, pl. II, figs. 12, 12a.

Chomatodus inconstans St. John and Worthen

5198. Plesiotype. Keokuk limestone. Keokuk, Iowa. Coll. A. H. Worthen, 1896. Eastman, 1903b, p. 204.

Cladodus urbs-ludovici Eastman

5179. Holotype. Devonian (New Albany black shale). Vicinity of Louisville, Ky. W. N. Longworth leg. Exch. Yale Peabody Museum. Eastman, 1908, p. 110, pl. III, fig. 3.

Cladoselache acanthopterygius Dean

5252 (Orig. No. E2474). Plesiotype. Cleveland shale. Lindale, Ohio. W. L. Bryant leg. Buffalo Museum of Science don., 1930. Headless fish. Hussakof and Bryant, 1919, p. 128, fig. 43, and pl. XLV (the illustrations are of the counterpart of our specimen).

Cladoselache pachypterygius Dean

5243. Holotype (counterpart). Waverly of Kentucky. American Museum of Natural History don. Caudal fin. Dean, 1909, p. 241, p. 222, fig. 17 (the figured counterpart is in the American Museum, No. 7583).

Clupea sp.

2001. Von Meyer, 1851a, pp. 89, 93, pl. XIV, fig. 4.
2002. Von Meyer, 1851a, p. 89, pl. XVI, fig. 13.
See Clupea humilis von Meyer.

Clupea gracilis von Meyer

1581 (Orig. No. 1011; B.S.N.H. 3476). Cushman, 1907, p. 270, as holotype, *errore* (von Meyer designated no specimens, 1848, pp. 781, 783; cf. von Meyer, 1851a, p. 92).
See Clupea humilis von Meyer.

Clupea humilis von Meyer

1581 (Orig. No. 1011; B.S.N.H. 3476). Cotype. Molasse. Unterkirchberg, near Ulm, Germany. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1851a, pp. 88, 92, pl. XVI, fig. 12; Cushman, 1907, p. 270, as holotype of *C. gracilis* von Meyer, and plesiotype of *C. humilis* von Meyer, *erroribus*.

1585 (Orig. No. 985; B.S.N.H. 3446). Cotype. Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1851a, pp. 90, 92, pl. XIV, fig. 5 (referred with doubt); Cushman, 1907, p. 271, as cotype of *C. ventricosa* von Meyer, *errore*.

1582 (Orig. No. 980; B.S.N.H. 3420). Plesiotype (cotype of *C. lanceolata* von Meyer). Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1851a, p. 88, p. 93, pl. XIV, fig. 2, as *C. lanceolata* von Meyer.

1583, 1584 (Orig. Nos. 983, 984; B.S.N.H. 3444, 3445). Plesiotype (holotype of *C. ventricosa* von Meyer). Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1851a, pp. 90, 93, pl. XIV, figs. 1a, 1b, as *C. ventricosa* von Meyer; Cushman, 1907, p. 271, as two cotypes of *C. ventricosa* von Meyer, *errore*.

2001 (Orig. No. 981; B.S.N.H. 3442). Plesiotype. Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History,

1925. Von Meyer, 1851a, pp. 89, 93, pl. XIV, fig. 4, as *Clupea sp.*, intermediate between *C. humilis* von Meyer and *C. lanceolata* von Meyer; Cushman, 1907, p. 271, as cotype as *C. lanceolata* von Meyer, *errore*.

2002 (Orig. No. 1007; B.S.N.H. 3472). Plesiotype. Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1851a, p. 89, pl. XVI, fig. 13, as *Clupea sp.*

Clupea lanceolata von Meyer

1582. Cotype. Von Meyer, 1851a, pp. 88, 93, pl. XIV, fig. 2.

2001 (B.S.N.H. 3442). Cushman, 1907, p. 271, as cotype, *errore*. See Clupea humilis von Meyer.

Clupea ventricosa von Meyer

1583, 1584 (B.S.N.H. 3444, 3445). Holotype. Von Meyer, 1851a, pp. 90, 93, pl. XIV, figs. 1a, 1b; Cushman, 1907, p. 271, as two of three cotypes, *errore*.

1585 (B.S.N.H. 3446). Cushman, 1907, p. 271, as cotype, *errore*. See Clupea humilis von Meyer.

Coccosteid

1381. Dean, 1901, p. 122, footnote ("cranium"). See Dinichthys pustulosus Eastman.

Coccosteus decipiens Agassiz

1403. Plesiotype. Lower Old Red. Edderton, near Tain, Ross, Scotland. Coll. Schultze, 1871. Stetson, 1930, p. 28, pl. VI, fig. 2.

1409. Plesiotype. Old Red. Orkney. Coll. Damon. Dean, 1909, p. 285, fig. 62G, p. 283.

2041. Plesiotype. Old Red. Sandwick, Pomona, Orkney. Dean, 1909, p. 284, fig. 62A, p. 283.

Corax affinis Agassiz

5170. Plesiotype (cotype of *C. appendiculatus* Agassiz). Upper Cretaceous. Maestricht. Coll. Bronn, 1859. Agassiz, Poiss. Foss., **3**, p. 227 (1843), as *C. appendiculatus*; pl. XXVI, fig. 3 (1835), as *Galeus appendiculatus*.

CORAX APPENDICULATUS Agassiz

5170. Cotype. Agassiz, Poiss. Foss., **3**, p. 227, pl. XXVI, fig. 3. See CORAX AFFINIS Agassiz.

CORAX PRISTODONTUS Agassiz

5169. Genocotype. Upper Cretaceous. Maestricht. Coll. Bronn, 1859. Agassiz, Poiss. Foss., **3**, pp. 224 f. (1843), pl. XXVI, fig. 9 (1835). Referred to Galeus on the plate.

COTTUS BREVIS Agassiz

1586, 1592 (B.S.N.H. 3491, 3492). 2 plesiotypes. Von Meyer, 1851a, p. 107, pl. XVI, figs. 7, 9, *errore*.
See LEPIDOCOTTUS MULTIPINNATUS (von Meyer).

COTTUS (?) CONICUS von Meyer

1586, 1592. Two cotypes. Von Meyer, 1851a, p. 109.
See LEPIDOCOTTUS MULTIPINNATUS (von Meyer).

COTTUS (?) MULTIPINNATUS von Meyer

1587. Holotype. Von Meyer, 1851a, p. 106, pl. XVII, fig. 1.
See LEPIDOCOTTUS MULTIPINNATUS (von Meyer).

COTTUS PAPYRACEUS Agassiz

5262 (formerly M.C.Z. 2911). Holotype. Agassiz, Poiss. Foss., **4**, p. 187 (1839), pl. XXXII, fig. 1 (1839).
See LEPIDOCOTTUS PAPYRACEUS (Agassiz).

CTENACANTHUS sp.

5189. Pennsylvanian. Carlinville, Ill. Coll. A. H. Worthen, 1896. Eastman, 1902b. p. 76.

CTENACANTHUS COXIANUS St. John and Worthen

5188. Plesiotype. Kinderhook. Iowa. Coll. A. H. Worthen, 1896. Eastman, 1902b, p. 87.

CTENACANTHUS GRACILLIMUS Newberry and Worthen

5184. Plesiotype. St. Louis limestone. Missouri? Coll. Ward, 1898. Eastman, 1902b, p. 86, text fig. 12.

Ctenacanthus hybodoides Egerton

5206 (formerly M.C.Z. 4213). Plesiotype. Coal Measures. Glasgow. J. M. Campbell leg. Coll. T. Stock, 1883. Scale. Stock, 1883, p. 185, pl. VII, fig. 16 (species credited to Agassiz).

Ctenacanthus longinodosus Eastman

5182. Paratype. Kinderhook limestone. Burlington, Iowa ("North hill exposure"). Coll. C. Wachsmuth, 1872. Young individual. Eastman, 1902b, p. 80, text fig. ~~8~~B, p. 79.

d/

Ctenacanthus semicostatus (St. John and Worthen)

5187. Holotype (genoholotype of *Anaclitacanthus semicostatus* St. J. and W.). Upper Burlington fish bed. Burlington, Iowa. Coll. C. Wachsmuth, 1872. St. John and Worthen, 1875, p. 443, pl. XVI, figs. 14a–c, as Anaclitacanthus; Eastman, 1902b, p. 89.

Ctenacanthus solidus Eastman

5185. Paratype. Kinderhook. Iowa? Coll. A. H. Worthen, 1896. Eastman, 1902b, p. 90.

Ctenacanthus varians St. John and Worthen

5186. Holotype. Kinderhook (upper fish bed). Flint River, near Burlington, Iowa. Coll. C. Wachsmuth, 1872. St. John and Worthen, 1875, p. 422, pl. XIV, figs. 2a–i; Eastman, 1902b, p. 89.

Ctenacanthus venustus Eastman

5183. Holotype. Kinderhook. Iowa? Coll. A. H. Worthen, 1896. Eastman, 1902b, pp. 81–83, text fig. 10, p. 83.

Cyprinus coryphaenoides Bronn

5069, 5175 (Orig. Nos. 4a–b, 13). Two cotypes. Bronn, 1830, pp. 20, 22, 28, pl. I, fig. 1 (synthetograph).

See Leptolepis coryphaenoides (Bronn).

Cyprinus papyraceus Bronn

5258, 5260 (formerly M.C.Z. 2908, and 2914, 2922). Two cotypes. Bronn, 1828, pp. 377–381, pl. III, fig. 9 (synthetograph).

5259 (formerly M.C.Z. 2931). Cotype. Bronn, 1828, pp. 377-381. See Leuciscus papyraceus (Bronn).

Cyprinus priscus von Meyer

1589 (Orig. No. 989; B.S.N.H. 3450). Cotype. Molasse. Unterkirchberg, near Ulm, Germany. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1848, p. 782; 1851a, p. 95, pl. XV, fig. 1.

1588 (Orig. No. 988; B.S.N.H. 3449). Cotype. Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1851, p. 80; 1851a, p. 96, pl. XV, fig. 2 (composite figure, pectoral fin from counterpart).

1591 (Orig. No. 1015; B.S.N.H. 3480). Cotype. Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History, 1925. Fin spine. Von Meyer, 1848, p. 782; 1851a, p. 97, pl. XV, fig. 5.

1590 (Orig. No. 990; B.S.N.H. 3451). Plesiotype. Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1856, p. 22, pl. I, fig. 1; Cushman, 1907, p. 271, as cotype, *errore*.

Deltodus contortus (St. John and Worthen)

5137. Holotype (genoholotype of *Taeniodus contortus* St. John and Worthen). Lower Carboniferous. Visé, Belgium. Coll. L. G. de Koninck, 1861. St. John and Worthen, 1883, p. 76, as Taeniodus; Eastman, 1903b, p. 202, pl. IV, fig. 37, 43.

Deltodus occidentalis (Leidy)

5134. Plesiotype. Keokuk limestone. Keokuk, Iowa. Coll. A. H. Worthen, 1896. Eastman, 1903b, p. 200, pl. IV, fig. 38.

Deltodus occidentalis latior St. John and Worthen

5127. Plesiotype. Keokuk limestone. Keokuk, Iowa. Coll. A. H. Worthen, 1896. Eastman, 1903b, p. 200, pl. V, fig. 53.

Deltodus spatulatus Newberry and Worthen

5121. Plesiotype. Burlington limestone. Burlington, Iowa. Coll. C. Wachsmuth, 1872. Eastman, 1903b, p. 200, pl. V, fig. 55.

5122. Plesiotype. Burlington limestone. Augusta, Iowa. Coll. Beebe, 1898. Eastman, 1903b, p. 200, pl. IV, fig. 42.

5139. Plesiotype. Keokuk limestone. Keokuk, Iowa. Coll. A. H. Worthen, 1896. Eastman, 1903b, p. 199, pl. IV, fig. 41.

Dictyopyge macrura (W. C. Redfield)

5068 (formerly M.C.Z. 2531). Plesiotype. Triassic. Locality unknown. Eastman, 1905, pl. XIII, as *Catopterus gracilis* J. H. Redfield, *errore*; 1911, p. 56.

Dinichthyid

1475. Cleveland shale. Vicinity of Cleveland, Ohio. Coll. Wm. Clark, 1896. Postero-ventro-median. Eastman, 1897c, p. 26, pl. V, fig. 1; 1907b, p. 144, and 1908, p. 205, as Titanichthys.

Dinichthys sp.

1299 (Orig. No. 15). Plesiotype. Cleveland shale. Lorain County, Ohio. Coll. J. Terrell, 1885. Antero-ventro-median. Eastman, 1897c, p. 26. This specimen cannot be found in the collections.

1300. (Orig. No. 20). Cleveland shale. Lorain County, Ohio. Coll. J. Terrell, 1885. Postero-ventro-median. Eastman, 1896, p. 47, as *Titanichthys sp.*; 1897c, p. 24, pl. II, fig. 2.

Dinichthys bohemicus (Barrande)

1376. Plesiotype. Devonian (Gg_1). Choteč, Bohemia. Coll. Schary, 1882. Median dorsal. Eastman, 1897c, pp. 37–38, pl. V, fig. 2.

1377. Plesiotype. Devonian (Gg_1). Svagerka, Bohemia. Coll.
7/ Schary, 1882. Median dorsal. Eastman, 1894c, pp. 33, 37–38, pl. II, fig. 3.

Dinichthys eifeliensis Kayser

1374. Plesiotype. Devonian. Berndorf, Eifel, Germany. Coll. Schultze, 1871. Carinal process of median dorsal. Eastman, 1897c, pp. 33, 36–37, pl. III, fig. 3.

1474. Plesiotype. Devonian. Eifel. Coll. Schultze, 1871. Right antero-ventro-lateral. Eastman, 1897c, pp. 36–37, pl. V, fig. 4.

Dinichthys intermedius Newberry

1343. Plesiotype. Cleveland shale. Lorain County, Ohio. Coll. J. Terrell, 1885. Left mandible. Stetson, 1930, p. 27, pl. V, fig. 2.

1380. Plesiotype. Cleveland shale. Vicinity of Lindale, Ohio.

Coll. Wm. Clark, 1896. Antero-ventro-median. Eastman, 1897c, p. 26, pl. III, fig. 1.

1477. Plesiotype. Cleveland shale. Vicinity of Cleveland, Ohio. Coll. Wm. Clark, 1896. Skull and jaw. Claypole, 1892, pp. 199–207, figures; Eastman, 1897c, pp. 19–20, pl. I, fig. 1 (cranium only); Stetson, 1930, p. 29 (and fig. 2, p. 30 — synthetograph with M.C.Z. 5244).

Dinichthys pelmensis Eastman

1375. Holotype. Devonian. Pelm, Eifel, Germany. Coll. Schultze, 1871. Median dorsal. Eastman, 1897c, pp. 33, 36, pl. II, fig. 4.

Dinichthys pustulosus Eastman

1381. Holotype. Mid-Devonian (Hamilton). Hydraulic cement quarries near Milwaukee, Wis. Coll. F. H. Day, 1881. Left antero-dorso-lateral. Eastman, 1897c, p. 39, pl. III, fig. 4; Dean, 1901, p. 122, footnote, as Coccosteid.

1389. Plesiotype. Mid-Devonian (Hamilton). White Sulphur Springs, two miles east of Buffalo, Iowa. Coll. J. A. Udden, 1898. Dorso-median. Hussakof, 1906, p. 142, fig. 22D, p. 141.

1390. Plesiotype. Mid-Devonian (Lower Cedar Valley limestone). Vicinity of Rock Island, Ill. A. S. Tiffany leg., 1883. Exch. with J. A. Udden, 1898. Cranium. Eastman, 1907b, fig. 25, p. 132, pl. XII; 1908, p. 194, fig. 28, p. 197, pl. IV.

5076. Plesiotype. Mid-Devonian (Hamilton). Buffalo, Iowa. J. A. Udden leg. and don., 1899. Fragmentary gnathal. Eastman, 1902c, p. 657.

Dinichthys terrelli Newberry

1301 (Orig. No. 29). Plesiotype. Cleveland shale. Lorain County, Ohio. Coll. J. Terrell, 1885. Antero-ventro-median. Eastman, 1896, p. 47, as *Titanichthys sp.*; 1897c, p. 25, pl. II, figs. 5–6.

1315 (Orig. No. 30). Plesiotype. Cleveland shale. Lorain County, Ohio. Coll. J. Terrell, 1885. Carinal process of median dorsal. Eastman, 1897c, p. 33, pl. III, fig. 2.

1325 (Orig. No. 31). Plesiotype. Cleveland shale. Lorain County, Ohio. Coll. J. Terrell, 1885. Left postero-dorso-lateral. Eastman, 1897c, p. 21. This specimen is missing at present.

1338 (Orig. No. 6). Plesiotype. Cleveland shale. Lorain County, Ohio. Coll. J. Terrell, 1885. Right suborbital. Stetson, 1930, pp. 23–25, fig. 1, p. 23.

1379. Plesiotype. Cleveland shale. Lindale, Ohio. Prentis Clark leg. Coll. Wm. Clark, 1896. Antero- and postero-dorso-laterals. fn Eastman, 1879c, p. 20, pl. II, fig. 1.

5242. Plesiotype. Cleveland shale. Ohio. Fragment of mandible. Stetson, 1930, p. 27, pl. V, fig. 1.

5244. Plesiotype. Cleveland shale. Ohio. Coll. J. Terrell, 1885. Mounted specimen. Stetson, 1930, pp. 19–26, pls. I, II, III, IV, VI, fig. 3 (and fig. 2, p. 30 — synthetograph with M.C.Z. 1477).

5245. Plesiotype. Cleveland shale. Ohio. Postero-dorso-lateral. Stetson, 1930, p. 27.

Dinomylostoma beecheri Eastman

The holotype is in the Yale Peabody Museum (No. 2850), not, as said by Hussakof (1913, p. 247, footnote), in the Museum of Comparative Zoölogy.

Diodon erinaceus Agassiz

5071. Plesiotype. Eocene. Monte Bolca, near Verona, Italy Eastman, 1904, p. 34, fig. D (fig. "4" in the text).

Diplodus sp.

3/ 5133. Knight, 1899, pp. 366, 372, 274.
See Phoebodus knightianus Eastman.

Dipnoan dental plate, gen. et sp. ind.

5098. Eastman, 1907b, pl. IV, fig. 15, p. 203.
See Synthetodus calvini Eastman.

Upper Devonian (state quarry beds). Johnson County, Iowa. Eastman, 1907b, pl. II, fig. 1. This specimen cannot be located in the collections.

5110. Eastman, 1907b, pl. IV, fig. 16.
See Dipterus digitatus Eastman.

Dipterus sp.

5092. Udden, 1899, p. 494, fig. 1.
See Dipterus uddeni Eastman.

5102. Palatal tooth. Eastman, 1907b, pl. IV, fig. 12; 1908, pl. II, fig. 17, p. 301.

5096, 5105. Eastman, 1907b, pl. IV, figs. 7, 2.

See Dipterus pectinatus Eastman.
5107. Eastman, 1907b, pl. IV, fig. 8.
See Dipterus digitatus Eastman.

Dipterus calvini Eastman

5093. Holotype. Mid-Devonian (Cedar Valley limestone). Fairport, Iowa. J. A. Udden leg. and don. Mandibular tooth. Eastman, 1900a, pp. 38–39, fig. 7; 1907b, p. 160, pl. IV, fig. 1; 1908, p. 219, pl. II, fig. 1.

Dipterus costatus Eastman

5094. Holotype. Upper Devonian (state quarry beds). North Liberty, Johnson County, Iowa. J. A. Udden leg. Coll. Calvin, 1897. Mandibular tooth. Eastman, 1900a, p. 39, fig. 4, p. 38; 1907b, p. 161, pl. IV, fig. 9; 1908, p. 220, pl. II, fig. 8.

Dipterus digitatus Eastman

5107. Cotype. Upper Devonian (state quarry beds). North Liberty, Iowa. Palatal tooth. Eastman, 1907b, pl. IV, fig. 8, as Dipterus sp.; 1908, p. 221, pl. II, fig. 6, and pl. VII, fig. 20.
5108. Four cotypes. State quarry beds. Johnson County, Iowa. Mandibular teeth. Eastman, 1908, p. 221, pl. VII, figs. 16–19, 25.
5109. Four cotypes. State quarry beds. Johnson County, Iowa. Palatal teeth. Eastman, 1908, p. 221, pl. VII, figs. 21–24.
5110. Cotype. State quarry beds. North Liberty, Iowa. Mandibular tooth. Eastman, 1907b, pl. IV, fig. 16, as Dipnoan dental plate; 1908, p. 221, pl. II, fig. 21, and pl. VII, fig. 25.

Dipterus mordax Eastman

5095. Two cotypes. Upper Devonian (state quarry beds). North Liberty, Johnson County, Iowa. J. A. Udden leg. Coll. Calvin, 1897. Mandibular teeth. Eastman, 1900a, pp. 39–40, figs. 6, 8, p. 38; 1907b, p. 161, pl. IV, figs. 5, 6; 1908, p. 220, pl. II, figs. 4, 5.
5113. Five plesiotypes. State quarry beds. Johnson County, Iowa. Mandibular teeth. Eastman, 1908, p. 220, pl. VII, figs. 5–9.

Dipterus murchisoni Pander

5103. Plesiotype. Devonian. Berndorf, Eifel, Germany. Coll. Schultze, 1871. Mandibular tooth. Eastman, 1900c, p. 177; 1908, p. 226, pl. II, fig. 10.

DIPTERUS NELSONI Newberry

5111. Plesiotype. Chemung. Warren, Pa. C. E. Beecher leg. and don. Mandibular tooth. Eastman, 1907b, p. 163, pl. IV, figs. 13, 14; 1908, p. 223, pl. II, figs. 11, 11a, and pl. VII, fig. 3.

5112. Two plesiotypes. Chemung. Warren County, Pa. Palatal and mandibular teeth. Eastman, 1908, p. 223, pl. VII, figs. 1, 4.

DIPTERUS PECTINATUS Eastman

5096. Cotype. Upper Devonian (state quarry beds). North Liberty, Johnson County, Iowa. Coll. Calvin, 1896. Palatal tooth. Eastman, 1907b, pl. IV, fig. 7, as *Dipterus sp.*; 1908, p. 222, pl. II, fig. 7.

5105. Cotype. State quarry beds. North Liberty, Iowa. Mandibular tooth. Eastman, 1907b, pl. IV, fig. 2, as *Dipterus sp.*; 1908, p. 222, pl. II, fig. 2, and pl. VII, fig. 13.

5106. Five cotypes. State quarry beds. Johnson County, Iowa. Palatal and mandibular teeth. Eastman, 1908, p. 223, pl. VII, figs. 10–12, 14, 15.

DIPTERUS UDDENI Eastman

5092. Holotype. Mid-Devonian (Cedar Valley limestone). Buffalo, Iowa. J. A. Udden leg. and don., 1899. Mandibular tooth. Udden, 1899, p. 494, fig. 1, as *Dipterus sp.*; Eastman, 1900a, p. 37, fig. 5, 5^1, p. 38; 1907b, p. 160, pl. IV. figs. 3, 4; 1908, p. 218, pl. II, figs. 3, 3a.

DREPANASPIS GEMUNDENENSIS Schlüter

5218. Plesiotype. Devonian. Gemünden, Hunsrück, Rhineland. T. Barbour don., 1928. Stetson, 1931, p. 150, fig. 5.

5219. Plesiotype. Devonian. Gemünden. T. Barbour don., 1928. Stetson, 1931, p. 151, figs. 6, 7 (synthetograph with M.C.Z. 5238).

5238. Plesiotype. Devonian. Gemünden. T. Barbour don., 1928. Stetson, 1931, p. 152, fig. 7 (synthetograph with M.C.Z. 5219).

ECZEMATOLEPIS FRAGILIS (Newberry)

5101. Plesiotype. Corniferous. Falls of the Ohio, Ind. Eastman, 1908, pp. 141, 142, pl. III, figs. 5, 5a, as Acantholepis.

EDESTUS HEINRICHSII Newberry and Worthen

5190. Plesiotype. Pennsylvanian. Carlinville, Ill. Coll. A. H. Worthen, 1896. Eastman, 1902b, p. 76, text fig. 7.

Elasmobranch dermal plate

5119. Kinderhook limestone. Burlington, Iowa. Coll. O. H. St. John, 1873. Eastman, 1903b, p. 220, fig. 16; 1908, p. 149, pl. II, figs. 15, 15a, as Chimaeroid (this figure is ca. x 2, not x $\frac{4}{5}$, as noted in the legend).

5131. Two specimens. Kinderhook. Burlington, Iowa. Coll. O. H. St. John, 1873. Eastman, 1903b, p. 220, pl. V, figs. 56, 56a, 57.

5135. Kinderhook. Burlington, Iowa. Coll. O. H. St. John, 1873. Eastman, 1903b, p. 220, pl. V, fig. 50.

Elonichthys brownii (Jackson)

5083 (B.S.N.H. 7900; formerly M.C.Z. 1961). Holotype. Mississippian. Albert Mines, New Brunswick. Exch. Boston Society of Natural History, 1897. Jackson, 1851, p. 22, as *Palaeoniscus brownii*; 1852, p. 139; Lambe, 1909, p. 169, figs. 3, 4, p. 173; 1910, p. 22, pl. I, fig. 2, pl. IV, fig. 1, pl. V, figs. 2, 3, 5, 6.

5085 (B.S.N.H. 7901; formerly M.C.Z. 1957). Plesiotype. Mississippian. Albert Mines, New Brunswick. Exch. Boston Society of Natural History, 1897. Lambe, 1910, pl. I, fig. 5, pl. IV, fig. 4.

5088 (B.S.N.H. 7903; formerly M.C.Z. 1953). Plesiotype. Mississippian. Albert Mines, New Brunswick. Exch. Boston Society of Natural History, 1897. Jackson, 1851, p. 24, as Palaeoniscus; Lambe, 1910, pl. II, fig. 7.

Elonichthys elegantulus Eastman

5221. Holotype. Mississippian. Albert Mines, New Brunswick. Exch. Boston Society of Natural History, 1897. Eastman, 1908, p. 274.

Elonichthys perpennatus Eastman

5104. Holotype. Pennsylvanian. Mazon Creek, Grundy County, Ill. C. E. Beecher leg. and don., 1899. Eastman, 1902d, p. 539 fig. 4; 1903b, p. 190, pl. V, fig. 49.

Erismacanthus barbatus Eastman

5138. Holotype. Kinderhook limestone. Burlington, Iowa. Coll. C. Wachsmuth, 1872. Eastman, 1903b, p. 211, pl. V, fig. 47.

Erismacanthus formosus Eastman

Holotype. Mississippian (St. Louis limestone). Vicinity of St. Louis, Mo. Coll. Hambach. Eastman, 1902c, p. 850, fig. 1; 1903b, p. 212, fig. 13. This specimen has not been found.

Erismacanthus maccoyanus St. John and Worthen

5199. Plesiotype. Kinderhook limestone. Le Grand, Iowa. Exch. United States National Museum, 1899. Eastman, 1903b, p. 212.

Fissodus dentatus Eastman

5130. Holotype. Pennsylvanian. Topeka, Kans. S. A. Miller leg., 1898. Eastman, 1903b, p. 175, pl. II, fig. 12.

Galeocerdo denticulatus Agassiz

5077. Holotype. Upper Cretaceous. Maestricht. Coll. Bronn, 1859. Agassiz, Poiss. Foss., **3**, p. 233 (1843), pl. XXVI, fig. 1 (1835). Referred to Galeus on the plate. Agassiz, 1856, p. 274, as Prionodon?

Galeus appendiculatus Agassiz

5170. Cotype. Agassiz, Poiss. Foss., **3**, pl. XXVI, fig. 3.
See Corax affinis Agassiz.

Galeus denticulatus Agassiz

5077. Holotype. Agassiz, Poiss. Foss., **3**, pl. XXVI, fig. 1.
See Galeocerdo denticulatus Agassiz.

Galeus pristodontus Agassiz

5169. Cotype. Agassiz, Poiss. Foss., **3**, pl. XXVI, fig. 9.
See Corax pristodontus Agassiz.

Gobius (?) sp.

5211. Von Meyer, 1856, p. 27, pl. I, fig. 6.
See Lepidocottus multipinnatus (von Meyer).

Gobius (?) conicus

1586, 1592. Two cotypes. Von Meyer, 1851, p. 80.
See Lepidocottus multipinnatus (von Meyer).

Gobius multipinnatus von Meyer

1587. Holotype. Von Meyer, 1848, p. 783.
See Lepidocottus multipinnatus (von Meyer).

Harpacanthus fimbriatus (Stock)

5201 (formerly M.C.Z. 4259). Genoholotype. Carboniferous limestone. Gilmerton, near Edinburgh, Scotland. W. Tait Kinnear and W. Anderson leg. Coll. T. Stock, 1883. Stock, 1883, p. 177, pl. VII, figs. 1, 1a, as Tristychius; Traquair, 1886, pp. 493–496.

Stock's fig. 1a is an erroneous reconstruction.

Helicoprion annectans (Eastman)

2039. Holotype (genoholotype of *Campyloprion annectans* Eastman). Carboniferous. Locality unknown. Exch. Tufts College. Eastman, 1902a, p. 151, fig. 3, p. 152, pl. VIII, fig. 2, also p. 332; 1902b, pp. 64 sqq., text figs. 3, 4, and pl. IV; 1903, p. 286, footnote, pl. XXI, fig. 1. All these references are to Campyloprion Eastman.

Helodus incisus Eastman

5123. Holotype. Mississippian. Salem, Ind. Cassiday leg. Coll. O. H. St. John, 1871. Eastman, 1903b, p. 204, pl. V, figs. 54a–b.

5124. Paratype. Mississippian. Salem, Ind. Cassiday leg. Coll. O. H. St. John, 1871. Eastman, 1903b, p. 205.

Hemipristis sp. ind.

5150, 5151. Two teeth. Pacific red clay. Albatross Station 3681. Eastman. 1903a, p. 188, text fig. 5, pl. I, figs. 7, 8.

Histionotophorus bassanii (de Zigno)

5176 (formerly M.C.Z. 3075. Plesiotype. Eocene. Monte Bolca, near Verona, Italy. Coll. C. R. Eastman, 1903. Eastman, 1904, p. 32, pl. I, figs. 1, 1a.

5177 (Orig. Nos. 14, 15; formerly M.C.Z. 3074). Plesiotype. Upper Eocene. Monte Bolca. Coll. Krantz, 1903. Eastman, 1904, p. 32, pl. I, fig. 2.

5178. Plesiotype. Upper Eocene. Monte Bolca. Eastman, 1904, p. 32, pl. I, fig. 3.

Text figure C is a synthetograph based on these three specimens.

Homacanthus acinaciformis Eastman

5115 (formerly M.C.Z. 1625). Holotype. Chemung. Warren, Pa. Coll. F. A. Randall, 1897. Eastman, 1903b, p. 218, pl. V, fig. 58; 1907b, p. 75, pl. I, fig. 16; 1908, p. 151, pl. III, fig. 10.

Homacanthus delicatulus Eastman

5126. Holotype. Kinderhook limestone. Le Grand, Iowa. Coll. A. H. Worthen, 1896. Eastman, 1903b, p. 218, pl. III, fig. 28, and pl. V, fig. 59; 1908, p. 152.

Lamna sp. ind.

5152. Two teeth. Pacific red clay. Albatross Station 3681. Eastman, 1903a, p. 186, pl. I, fig. 9, 10.

5160. Two teeth. Pacific green mud. Albatross Station 4656. Eastman, 1906a, p. 80, pl. II, figs. 6, 7.

Lamna (Odontaspis) bronnii Agassiz

5197. Two cotypes. Agassiz, Poiss. Foss., **3**, p. 297, pl. XXXVIIa, figs. 8, 9.

See Odontaspis bronnii Agassiz.

Lamna lata (Agassiz)

5195. Holotype. Upper Cretaceous. Pietersberg, Maestricht. Coll. Bronn, 1859. Agassiz, Poiss. Foss., **3**, p. 271 (1843), pl. XXXII, fig. 26 (1838), as *Otodus latus*.

Lanarkia horrida Traquair

5215. Plesiotype. Downtonian. Monks Burn, Lanarkshire, Scotland. H. C. Stetson leg. and don., 1927. Stetson, 1931, p. 147, fig. 4.

5216. Plesiotype. Downtonian. Seggholm, Ayrshire. D. Stitt leg. H. C. Stetson don., 1927. Stetson, 1931, p. 148.

5239. Plesiotype. Downtonian. Seggholm. H. C. Stetson leg. and don., 1927. Stetson, 1931, p. 149.

Lasanius problematicus Traquair

1565. Plesiotype. Downtonian. Seggholm, Ayrshire. H. C. Stetson and D. Tait leg., 1926. Stetson, 1927, figs. 1, 2, pp. 250, 251.

Lepidocottus multipinnatus (von Meyer)

1587 (Orig. No. 1028; B.S.N.H. 3493). Holotype. Molasse. Unterkirchberg, near Ulm, Germany. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1848, p. 783, *Gobius multipinnatus*; 1851a, p. 106, pl. XVII, fig. 1, as *Cottus* (?) *multipinnatus*.

1586, 1592 (Orig. Nos. 1026, 1027; B.S.N.H. 3491, 3492). Two plesiotypes (cotypes of *Gobius* (?) *conicus* von Meyer). Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1851, p. 80, as *Gobius* (?) *conicus* von Meyer; 1851a, p. 109, as *Cottus* (?) *conicus* von Meyer; 1851a, p. 107, pl. XVI, figs. 7, 9, as *Cottus brevis* Agassiz, *errore*. No. 1592 cannot be found and has not been seen; its identification as this type is uncertain.

5211 (Orig. No. 986; B.S.N.H. 3447). Plesiotype. Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1856, p. 27, pl. I, fig. 6, as *Gobius ?*

Woodward (1901, p. 584) refers this specimen to this species, but it agrees much better with *L. papyraceus* (Agassiz).

Lepidocottus papyraceus (Agassiz)

5262 (formerly M.C.Z. 2911). Holotype. Oligocene. Monte Viale, near Vicenza, Italy. Coll. Bronn, 1859. Agassiz, 1832, p. 137 (nom. nud.); Poiss. Foss., **4**, p. 187 (1839), pl. XXXII, fig. 1 (1839), as *Cottus papyraceus* Agassiz.

Lepidosteus atrox Leidy

516~~6~~. Plesiotype. Eocene (Green River shales). Fossil, Wyo. 18
D. C. Haddenham leg., 1899. Eastman, 1900, pp. 57–58; 1900b, pp. 69–72, pl. I, fig. 2.

Leptolepis bronnii Agassiz

5069, 5175. Two genocotypes. Agassiz, 1832, p. 146.
See Leptolepis coryphaenoides (Bronn).

Leptolepis coryphaenoides (Bronn)

5069, 5175 (Orig. Nos. 4a–b, 13; formerly M.C.Z. 2970–2971, 2565). Two genocotypes. Lias. The Baar, Baden, Germany. Coll. Bronn, 1859, ex Coll. Althaus, 1826. Bronn, 1830, pp. 20, 22, 28, pl. I, fig. 1 (synthetograph), as Cyprinus; Agassiz, 1832, p. 146, as *L. bronnii* Agassiz.

Leuciscus gibbus von Meyer

2004 (Orig. No. 1013; B.S.N.H. 3478). Holotype. Molasse. Unterkirchberg, near Ulm, Germany. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1851, p. 80; 1851a, p. 98, pl. XV, fig. 6.

5210 (Orig. No. 1014; B.S.N.H. 3479). Plesiotype. Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1856, p. 24, pl. I, fig. 2.

Leuciscus papyraceus (Bronn)

5258, 5260 (formerly M.C.Z. 2908 and 2914, 2922). Two cotypes. Oligocene. Geistinger Busch, Siebengebirge, Germany. Coll. Bronn, 1859, ex Coll. Goldfuss, 1828. Bronn, 1828, pp. 377–381, pl. III, fig. 9 (synthetograph), as Cyprinus; Agassiz, 1832, p. 132; Poiss. Foss., **5**, Pt. 2, p. 31 (1839), pl. LVI, figs. 1, 3–4 (1835).

5259 (formerly M.C.Z. 2931). Cotype. Oligocene. Geistinger Busch. Coll. Bronn, 1859. Bronn, 1828, pp. 377–381, as Cyprinus; Agassiz, 1832, p. 132; Poiss. Foss., **5**, Pt. 2, p. 31 (1839), pl. LVI, fig. 2 (1835).

The Bronn Collection also includes a small series of this species, of which at least part belongs to the original material, as is indicated by Bronn's old labels bearing the horizon and locality and the notation, "von Prof. Goldfuss in Tausch, 1828." Another label, however, shows that some of this material was not acquired by Bronn till 1830. Therefore it is possible that No. 5259, which was figured by Agassiz alone, may not be a cotype, but merely a plesiotype.

Macropetalichthys agassizii (von Meyer)

5174. Plesiotype. Woodward, 1891, p. 303; Eastman, 1907b, pp. 101, 112; 1908, p. 175.

See Macropetalichthys hoeninghausi (von Meyer).

Macropetalichthys hoeninghausi (von Meyer)

5174. Holotype (genoholotype of *Physichthys hoeninghausi* von Meyer). Devonian. Prüm, Eifel, Germany. Kröffges leg., 1859. Coll. Schultze, 1871. Von Meyer, 1855, pp. 80, 83, pl. XV, figs. 1–5, as Physichthys; Woodward, 1890, p. 459; 1891, p. 303; Eastman, 1898, p. 487; 1900c, p. 177; 1907b, pp. 101, 112; 1908, p. 175, as *M. agassizii* (von Meyer); Stetson, 1930, pp. 32–33, fig. 3.

In the absence of a detailed description of the type of *Macrope-*

talichthys agassizii (von Meyer), the name *M. hoeninghausi* is kept for our specimen (5174), although both may represent the same species. Cf. Stetson, 1930, p. 32.

MACROPETALICHTHYS RAPHEIDOLABIS Norwood and Owen

1427. Plesiotype. Onondaga limestone. Lime Rock, Genesee County, N. Y. Coll. Ward, 1896. Dissecting cranium. Stetson, 1930, p. 31, pl. VI, fig. 4, and pl. VII, figs. 1, 2.

1428. Plesiotype. Onondaga limestone. Lime Rock, N. Y. Coll. Ward, 1896. Median posterior of cranium. Eastman, 1897b, p. 497, pl. XII, fig. 2, as *M. sullivanti* Newberry; 1907b, p. 107, fig. 21.

2062 (Orig. No. M. No. 10). Plesiotype. Devonian. Sandusky, Ohio. Coll. A. A. Wright. Exch. Oberlin College Museum, 1896. Three detached sinistral plates. Eastman, 1897b, p. 497, pl. XII, fig. 3, as *M. sullivanti* Newberry.

MACROPETALICHTHYS SULLIVANTI Newberry

1428, 2062. Two plesiotypes. Eastman, 1897b, p. 497, pl. XII, figs. 2, 3.

See MACROPETALICHTHYS RAPHEIDOLABIS Norwood and Owen.

MEGALICHTHYS MACROPOMUS Cope

5143. Plesiotype. Pennsylvanian. Lansing, Kans. Oscar Lamb leg., 1888. Coll. O. H. St. John, 1900. Eastman, 1903b, p. 187.

MYLIOBATIS sp.

5193. Eocene. Ashley River, S. C. Caudal spine. Eastman, 1901, pl. XIII, fig. 4.

5194. Eocene (Jackson group). Montgomery, La. Coll. F. V. Hopkins. Caudal spine. Eastman, 1901, pl. XIII, fig. 5.

MYLIOBATIS MAGISTER Leidy

2063. Plesiotype. Eocene. Ashley River, S. C. Coll. Capt. Bowman. Upper dentition. Eastman, 1901, p. 100, pl. XII, fig. 3, and pl. XIII, figs. 1a–b.

MYLOSTOMA NEWBERRYI Eastman

1439 (Orig. No. 22). Cotype. Cleveland shale. Sheffield, Ohio. Coll. Terrell, 1885. Eastman, 1906, p. 23, pl. I, fig. 7, as *M. variabile* Newberry; 1907a, p. 224, fig. D (partim).

Mylostoma terrelli Newberry

1430 (Orig. No. 25). Holotype. Cleveland shale. Sheffield, Ohio. Coll. J. Terrell, 1885. Newberry, 1883, p. 147; 1889, p. 164, pl. XIV, figs. 1, 2; Eastman, 1906, p. 23, pl. III, fig. 21. Hussakof (1908, p. 17) unites this species with *M. variabile.*

Mylostoma variabile Newberry

1429 (Orig. No. 26b). Genocotype. Cleveland shale. Sheffield, Ohio. Coll. J. Terrell, 1885. Newberry, 1883, p. 146; 1889, p. 165, pl. XV, figs. 1, 2; Eastman, 1906, p. 23, pl. III, fig. 19.

1431 (Orig. No. 26). Genocotype. Cleveland shale. Sheffield, Ohio. Coll. J. Terrell, 1885. Newberry, 1883, p. 146; 1889, p. 165, pl. XV, fig. 3; Eastman, 1906, p. 23, pl. III, fig. 20.

1435 (Orig. No. 27a). Genocotype. Cleveland shale. Sheffield, Ohio. Coll. J. Terrell, 1885. Newberry, 1883, p. 146; 1889, p. 165, pl. XV, figs. 4, 4a; Eastman, 1906, p. 23, pl. I, fig. 2.

1436 (Orig. No. 27). Genocotype. Cleveland shale. Sheffield, Ohio. Coll. J. Terrell, 1885. Newberry, 1883, p. 146; 1889; p. 165, pl. XV, figs. 5, 5a; Eastman, 1906, p. 23, pl. II, fig. 15.

1437 (Orig. No. 27c). Plesiotype. Cleveland shale. Sheffield, Ohio. Coll. J. Terrell, 1885. Eastman, 1906, p. 23, pl. I, fig. 9; 1907a, pl. (specimen at reader's right of group).

1438 (Orig. No. 27b). Plesiotype. Cleveland shale. Sheffield, Ohio. Coll. J. Terrell, 1885. Eastman, 1906, p. 23, pl. II, fig. 11.

1439 (Orig. No. 22). Plesiotype. Eastman, 1906, p. 23, pl. I, fig. 7. See Mylostoma newberryi Eastman.

1490. Plesiotype. Cleveland shale. Vicinity of Cleveland, Ohio. Coll. W. Kepler, 1901. Dean, 1901, p. 101, pl. VIII; Eastman, 1907a, pp. 215 ff., figs. A, B, C. This specimen is the counterpart of No. 7526 in the American Museum of Natural History.

Odontaspis bronnii Agassiz

5197. Two cotypes. Upper Cretaceous. Pietersberg, Maestricht. Coll. Bronn, 1859. Agassiz, Poiss. Foss., **3**, p. 297 (1843), pl. XXXVIIa, figs. 8, 9 (1844), as *Lamna (O.) bronnii.*

5196. Two plesiotypes (cotypes of *Otodus serratus* Agassiz). Upper Cretaceous. Pietersberg, Maestricht. Coll. Bronn, 1859. Agassiz, Poiss. Foss., **3**, p. 272 (1843), pl. XXXII, figs. 27, 28 (1838), as *Otodus serratus*; Woodward, 1889, p. 360, 401.

ONYCHODUS sp. ind.

5091. Devonian. Mühlenberg, near Gerolstein, Eifel, Germany. Coll. Schultze, 1871. Woodward, 1891, p. 393; Eastman, 1907b, p. 169, pl. I, fig. 4; 1908, p. 240, pl. I, fig. 12 ($\frac{7}{8}$ natural size, not $\frac{3}{4}$ as noted).

ONYCHODUS HOPKINSI Newberry

5078 (Orig. No. 1199). Plesiotype. Chemung. Franklin, N. Y. Coll. Dyer, 1879. Eastman, 1899, p. 322, fig. 3 (error in text refers to fig. 2), as *O. sigmoides*; 1907b, p. 169, pl. I, fig. 14.

ONYCHODUS SIGMOIDES Newberry

5078. Plesiotype. Eastman, 1899, p. 322, fig. 3 (error in text refers to fig. 2).

See ONYCHODUS HOPKINSI Newberry.

ORODUS INTERMEDIUS Eastman

5120. Holotype. Pennsylvanian. Vicinity of Weston, Mo. Coll. S. A. Miller, 1898. Eastman, 1903b, p. 183, pl. IV, figs. 35, 36.

OTODUS LATUS Agassiz

5195. Holotype. Agassiz, Poiss. Foss., **3**, p. 271 (1843), pl. XXXII, fig. 26 (1838).

See LAMNA LATA (Agassiz).

OTODUS SERRATUS Agassiz

5196. Two cotypes. Agassiz, Poiss. Foss., **3**, p. 272 (1843), pl. XXXII, figs. 27, 28 (1838).

See ODONTASPIS BRONNII Agassiz.

OXYRHINA sp.

5164. Pacific dark brown clay. ALBATROSS Station 4701. Eastman, 1906a, pp. 81, 82, pl. II, fig. 18.

OXYRHINA CRASSA Agassiz

5145. Two plesiotypes. Tertiary phosphates. Coosaw, S. C. Coll. Capt. Bowman. Upper lateral teeth. Eastman, 1903a, p. 186, figs. 1–2, 3.

5153. Three plesiotypes. Pacific red clay. Albatross Station 3681. Anterior teeth. Eastman, 1903a, p. 185, pl. I, figs. 11–13.

5154. Five plesiotypes. Pacific red clay. Albatross Station 3681. Postero-lateral teeth. Eastman, 1903a, p. 185, pl. I, figs. 14–18.

5155. Plesiotype. Pacific red clay. Albatross Station 3681. Lateral tooth. Eastman, 1903a, p. 185, pl. I, fig. 20.

5156. Plesiotype. Pacific red clay. Albatross Station 3683. Lateral tooth. Eastman, 1903a, p. 185, pl. I, fig. 19.

5158. Three plesiotypes. Pacific radiolarian ooze. Albatross Station 4658. Postero-lateral teeth. Eastman, 1906a, pp. 80, 82, pl. II, figs. 1–3.

5159. Two plesiotypes. Pacific green mud. Albatross Station 4656. Postero-lateral teeth. Eastman, 1906a, pp. 80, 82, pl. II, figs. 4, 5.

5161. Two plesiotypes. Pacific brown clay. Albatross Station 4701. Postero-lateral teeth. Eastman, 1906a, pp. 81, 82, pl. II, figs. 8, 9.

5162. Seven plesiotypes. Pacific brown clay. Albatross Station 4685. Eastman, 1906a, pp. 80, 82, pl. II, figs. 10–12, 14–17.

Oxyrhina hastalis Agassiz

5171, 5172. Two plesiotypes (cotypes of *O. xiphodon* Agassiz). Miocene. Paris, France. Coll. Bronn, 1859. Agassiz, Poiss. Foss., **3**, p. 278 (1843), pl. XXXIII, figs. 11, 12, as *O. xiphodon.*

5173. Plesiotype (cotype of *O. plicatilis* Agassiz). Pliocene. Castel-Arquato, Italy. Coll. Bronn, 1859. Agassiz, Poiss. Foss., **3**, p. 279 (1843), pl. XXXVII, figs. 14, 14a (1844) as *O. plicatilis.*

Oxyrhina plicatilis Agassiz

5173. Cotype. Agassiz, Poiss. Foss., **3**, p. 279 (1843), pl. XXXVII, figs. 14, 14a (1844).

See Oxyrhina hastalis Agassiz.

Oxyrhina xiphodon Agassiz

5171, 5172. Two cotypes. Agassiz, Poiss. Foss., **3**, p. 278 (1843), pl. XXXIII, figs. 11, 12 (1838).

See Oxyrhina hastalis Agassiz.

Palaeomylus predator Eastman

2050. Holotype. Devonian. Gerolstein, Eifel, Germany. Coll. Schultze, 1871. Eastman, 1898, p. 549, fig. 43, p. 483.

Palaeoniscus sp.

5086, 5087 (B.S.N.H. 7897, 7897a; formerly M.C.Z. 1959, 1958). Jackson, 1851, pp. 23, 24; Lambe, 1910, p. 17, pl. II, figs. 2, 2 bis, and 3.
See Rhadinichthys alberti (Jackson).
5088 (B.S.N.H. 7903; formerly M.C.Z. 1953). Jackson, 1851, p. 24; Lambe, 1910, p. 17, pl. II, fig. 7.
See Elonichthys brownii (Jackson).

Palaeoniscus alberti Jackson

5082 (B.S.N.H. 7899; formerly M.C.Z. 1960). Holotype. Jackson, 1851, p. 22; 1852, p. 138; Lambe, 1910, pp. 17, 21, pl. I, fig. 1.
See Rhadinichthys alberti (Jackson).

Palaeoniscus brownii Jackson

5083 (B.S.N.H. 7900; formerly M.C.Z. 1961). Holotype. Jackson, 1851, p. 22; 1852, p. 139; Lambe, 1910, pp. 17, 22, pl. I, fig. 2.
See Elonichthys brownii (Jackson).

Palaeoniscus cairnsii Jackson

5084 (B.S.N.H. 7899a; formerly M.C.Z. 1956). Holotype. Jackson, 1851, p. 22; 1852, p. 139; Lambe, 1910, pp. 17, 21, pl. I, fig. 3.
See Rhadinichthys alberti (Jackson).

Palaeophichthys parvulus Eastman

5090. Genoholotype. Pennsylvanian. Mazon Creek, Grundy County, Ill. Coll. S. S. Strong. Yale Peabody Museum don. Eastman, 1908, p. 253, fig. 37 (figure is x 3, not x 2 as noted).

Peripristis benniei (Etheridge, Jr.)

270. Plesiotype. Carboniferous. Richmond, Yorkshire, England. Coll. L. Agassiz, 1859. Eastman, 1902a, p. 391, fig. 2, p. 390.

PERIPRISTIS SEMICIRCULARIS (Newberry and Worthen)

5191. Plesiotype. Chester limestone. Montgomery Switch, Caldwell County, Ky. E. O. Ulrich leg., 1898. Lower tooth. Eastman, 1902a, p. 389, figs. 1a–b, p. 390; 1903b, p. 179, fig. 7.

5192. Plesiotype. Chester limestone. Montgomery Switch, Caldwell County, Ky. E. O. Ulrich leg., 1898. Upper tooth. Eastman, 1903b, p. 179, text fig. 8, pl. III, fig. 25.

PETALORHYNCHUS PSITTACINUS (McCoy)

157. Plesiotype. Lower Carboniferous. Armagh, Ireland. Coll. L. G. de Koninck, 1861. Series of seven teeth. Eastman, 1903b, p. 171, fig. 4.

PHOEBODUS sp.

5133. Eastman, 1899a, p. 491.
See PHOEBODUS KNIGHTIANUS Eastman.

PHOEBODUS DENS-NEPTUNI Eastman

5132. Holotype. Keokuk limestone. Keokuk, Iowa. Coll. A. H. Worthen, 1896. Eastman, 1903b, p. 196, pl. IV, fig. 39.

PHOEBODUS KNIGHTIANUS Eastman

5133. Holotype and paratype. Permo-Carboniferous (Florence flint). Blue Springs, Nebr. W. C. Knight leg., 1898. Knight, 1899, pp. 366, 372, 374, as *Diplodus sp.*; Eastman, 1903b, p. 169, pl. IV, figs. 40, 40a.

1899a, p. 491;

PHOEBODUS POLITUS Newberry

5089. Plesiotype. Cleveland shale. Lorain County, Ohio. Coll. J. Terrell, 1885. Eastman, 1899a, p. 491, pl. VII, fig. 5; 1907b, p. 61, pl. I, fig. 12; 1908, p. 106, pl. I, fig. 9.

PHYSICHTHYS ? sp.

1459, 1458. Two fragments. Von Meyer, 1855, pp. 81–82, pl. XV, figs. 6, 7–8.
See PTERICHTHYS RHENANUS Beyrich.

2059. Two fragments. Von Meyer, 1855, p. 82, pl. XV, figs. 9, 10–11.
See RHYNCHODUS ROSTRATUS Eastman.

Physichthys hoeninghausi von Meyer

5174. Genoholotype. Von Meyer, 1855, pp. 80, 83, pl. XV, figs. 1–5.

See Macropetalichthys hoeninghausi (von Meyer).

Physonemus arcuatus McCoy

1550. Plesiotype. Mississippian (St. Louis limestone). Alton, Ill. Coll. A. H. Worthen, 1896. Eastman, 1903b, p. 208, fig. 12.

Physonemus hamus-piscatorius Eastman

5125. Two cotypes. Kinderhook limestone. Burlington, Iowa. Coll. C. Wachsmuth, 1872. Eastman, 1903b, p. 207, pl. V, figs. 45, 46.

Physonemus pandatus Eastman

5140 (Orig. No. 54). Holotype. Kinderhook limestone. Bogus Hollow, Burlington, Iowa. Coll. C. Wachsmuth, 1872. Eastman, 1903b, p. 207, pl. V, fig. 44.

Prionodon ? denticulatus Agassiz

5077. Agassiz, 1856, p. 274.

See Galeocerdo denticulatus Agassiz.

Protitanichthys fossatus Eastman

5220. Genoholotype. Delaware limestone. Delaware, Ohio. Coll. H. Herzer, 1898. Eastman, 1907b, p. 144, fig. 30, p. 146, pl. X, fig. 2; Hussakof, 1908a, p. 311, as Coccosteus?

Pterichthys rhenanus Beyrich

1458. Plesiotype. Devonian. Prüm, Eifel, Germany. Kröffges leg., 1858. Coll. Schultze, 1871. Anterior median dorsal. Von Meyer, 1855, p. 82, pl. XV, figs. 7–8, as Physichthys?; Woodward, 1890, p. 459; 1891, p. 222; Eastman, 1898, p. 487.

1459. Plesiotype. Devonian. Prüm. Coll. Schultze, 1871. Left posterior ventro-lateral. Von Meyer, 1855, p. 81, pl. XV, fig. 6, as Physichthys?; Woodward, 1890, p. 459; Eastman, 1898, p. 487.

Ptyctodus calceolus Newberry and Worthen

2054. Plesiotype. Upper Devonian (state quarry beds). North Liberty, Iowa. Coll. Calvin, 1897. Eastman, 1898, p. 477, fig. 15.

2055. Thirteen plesiotypes. State quarry beds. North Liberty, Iowa. Coll. Calvin, 1897. Eastman, 1898, pp. 477–478, figs. 1–10, 14, 16–17.

2056. Three plesiotypes. State quarry beds. North Liberty, Iowa. Coll. Calvin, 1897. Eastman, 1898, p. 478, figs. 11–13, p. 477.

Ptyctodus compressus Eastman

2052. Two cotypes. Upper Devonian (state quarry beds). North Liberty, Iowa. C. R. Eastman leg., 1897. Eastman, 1898, p. 479, figs. 21, 23, p. 477.

2053. Eight cotypes. State quarry beds. North Liberty, Iowa. C. R. Eastman leg., 1897. Eastman, 1898, p. 479, figs. 18–20, 22, 24–27, p. 477.

Ptyctodus ferox Eastman

2051. Holotype. Mid-Devonian (Hamilton). Milwaukee, Wis. E. E. Teller leg. and don., 1898. Eastman, 1898, p. 480, fig.35; 1908, p. 136, fig. 22.

Ptyctodus molaris Eastman

2048. Holotype. Devonian. Prüm, Eifel, Germany. Kröffges leg., 1859. Coll. Schultze, 1871. Eastman, 1897a, p. 115, fig. 10B; 1898, p. 475, fig. 28, p 477.

2049. Two paratypes. Devonian. Eifel. Coll. Schultze, 1871. Eastman, 1897a, p. 115; 1898, p. 475, figs. 29, 30, p. 477.

Ptyctodus panderi Eastman

2046. Holotype. Devonian. Berndorf, Eifel, Germany. Kröffges leg., 1859. Coll. Schultze, 1871. Eastman, 1898, p. 484, fig. 32, p. 477.

2045. Three paratypes. Devonian. Gerolstein, Eifel. Kröffges leg., 1859. Coll. Schultze, 1871. Eastman, 1898, p. 484, figs. 31, 33, 34, p. 477.

Ptyctodus punctatus Eastman

2058. Holotype. Devonian (Onondaga). Le Roy, N. Y. Coll. Ward, 1901. Eastman, 1907b, p. 70, fig. 15a (the figure is not natural size, as noted, but is nearly twice that); 1908, p. 133, pl. III, fig. 6.

Pygaeus agassizii Eastman

5073. Holotype. Eocene. Monte Bolca, near Verona, Italy. Coll. Canossa, through Krantz, 1903. Eastman, 1904, p. 31, pl. II.

Pygaeus nobilis Agassiz

5264. Agassiz, 1835, pp. 12, 20, 29, 39; 1835a, pp. 295, 302, 309, 313; Poiss. Foss., **4**, p. 16* (1838), p. 253 (1842), *errore*.
See Acanthurus ovalis Agassiz.

Rhadinichthys ? sp.

5114 (formerly M.C.Z. 1620). Chemung. Warren, Pa. Coll. F. A. Randall, 1899. Eastman, 1907b, p. 172, pl. IV, figs. 10, 11, and pl. IX, fig. 4; 1908, p. 260.

Rhadinichthys alberti (Jackson)

5082 (B.S.N.H. 7899; formerly M.C.Z. 1960). Holotype. Mississippian. Albert Mines, New Brunswick. Exch. Boston Society of Natural History, 1897. Jackson, 1851, p. 22; 1852, p. 138, as Palaeoniscus; Lambe, 1909, p. 168; 1910, p. 21, pl. I, fig. 1.

5084 (B.S.N.H. 7899a; formerly M.C.Z. 1956). Plesiotype (holotype of *Palaeoniscus cairnsii* Jackson). Mississippian. Albert Mines. Exch. Boston Society of Natural History, 1897. Jackson, 1851, p. 22; 1852, p. 139, as *Palaeoniscus cairnsii* Jackson; Eastman, 1908, p. 262, as *Rhadinichthys cairnsii* (Jackson); Lambe, 1909, p. 168, fig. 2, p. 173; 1910, p. 21, pl. I, fig. 3, and pl. III, fig. 4. 19-

5086 (B.S.N.H. 7897; formerly M.C.Z. 1959). Plesiotype. Mississippian. Albert Mines. Exch. Boston Society of Natural History, 1897. Jackson, 1851, p. 23, as *Palaeoniscus sp.*; Lambe, 1910, pl. II, fig. 2, 2bis.

5087 (B.S.N.H. 7897a; formerly M.C.Z. 1958). Plesiotype. Mississippian. Albert Mines. Exch. Boston Society of Natural History, 1897. Jackson, 1851, p. 24, as *Palaeoniscus sp.*; Lambe, 1909, p. 168, fig. 1 (?), p. 173 (cf. Lambe, 1910, pl. III, fig. 5); 1910, pl. II, fig. 3, and pl. III, figs. 5, 6.

Rhadinichthys cairnsii (Jackson)

5084 (B.S.N.H. 7899a; formerly M.C.Z. 1956). Holotype. Eastman, 1908, p. 262.
See Rhadinichthys alberti (Jackson).

Rhadinichthys deani Eastman

5222. Cotype. Waverly series. Vicinity of Junction City, Boyle County, Ky. Moritz Fischer leg., 1907. Eastman, 1908, pp. 264, 267, figs. 40A–A[1], and pl. XIII, figs. 8, 9; Parker, 1908, p. 272.

5223, 5225–5236. Thirteen cotypes. Waverly series. Boyle County, Ky. Moritz Fischer leg., 1907. Eastman, 1908, pp. 264, 267, 268, figs. 40, 41, and pl. XIII.

5224. Cotype. Waverly series. Boyle County, Ky. Birdie Linney leg., 1907. Eastman, 1908, fig. 40c, p. 267.

5257. Cotype. Waverly series. Boyle County, Ky. Moritz Fischer leg., 1907. Eastman, 1908, pp. 264, 266.

Rhombus kirchberganus von Meyer

2000. Cotype. Von Meyer, 1848, p. 782.
See Solea kirchbergana von Meyer.

Rhynchodus sp. ind.

2059–A. Woodward, 1891, p. 39.
See Rhynchodus rostratus Eastman.

Rhynchodus major Eastman

2042. Holotype. Devonian. Berndorf, near Kerpen, Eifel, Germany. Coll. Schultze, 1871. Eastman, 1898, p. 487, fig. 42, p. 483.

Rhynchodus rostratus Eastman

2043. Five cotypes. Devonian. Eifel, Germany. Coll. Schultze, 1871. Eastman, 1898, p. 487, figs. 41, 44–47, p. 483.

2059. Two cotypes. Devonian. Prüm, Eifel. Kröffges leg., 1859. Coll. Schultze, 1871. Von Meyer, 1855, p. 82, pl. XV, figs. 9, 10–11, as Physichthys?; Woodward, 1891, p. 39; Eastman, 1898, p. 487.

Semionotus nilssoni Agassiz

5067 (formerly M.C.Z. 2685). Holotype. Upper Triassic. Scania, Sweden. Nilsson, 1824, p. 103, pl. II, fig. 1, as an indeterminate acanthopterygian; Agassiz, Poiss. Foss., **2**, Pt. 1, p. 229 (1837), pl. XXVIIa, figs. 1–5 (1844); Eastman, 1905, p. 74, figs. 10, 11; 1911, p. 58, pl. VI.

Smerdis elongatus von Meyer

1593 (Orig. No. 1000; B.S.N.H. 3465). Holotype. Molasse. Unterkirchberg, near Ulm, Germany. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1851, p. 80; 1851a, p. 110, pl. XVI, fig. 6.

SMERDIS FORMOSUS von Meyer

2003 (Orig. No. 992; B.S.N.H. 3453). Four cotypes. Molasse. Unterkirchberg, near Ulm, Germany. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1848, p. 783; 1851a, p. 110, pl. XVI, fig. 5; Cushman, 1907, p. 271, as holotype.

SMERDIS MINUTUS (Blainville)

1594 (Orig. No. 994; B.S.N.H. 3455). Plesiotype. Molasse. Unterkirchberg, near Ulm, Germany. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1848, p. 783; 1851a, p. 109, pl. XVI, figs. 1, 2.

1595 (Orig. No. 993; B.S.N.H. 3454). Two plesiotypes. Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1848, p. 783; 1851a, p. 109, pl. XVI, fig. 3.

Von Meyer credits the species to Agassiz.

SOLEA ANTIQUA von Meyer

2005 (B.S.N.H. 3486). Holotype. Von Meyer, 1851, p. 80; 1851a, p. 103, pl. XVII, figs. 4, 5, 6, 7; Cushman, 1907, p. 272, as cotype, *errore*.

1596 (B.S.N.H. 3484). Cushman, 1907, p. 272, as cotype, *errore*.

1598 (B.S.N.H. 3487). Plesiotype. Von Meyer, 1856, p. 26, pl. I, fig. 4.

5212. Plesiotype. Von Meyer, 1856, p. 26, pl. I, fig. 5.

See SOLEA KIRCHBERGANA von Meyer.

SOLEA KIRCHBERGANA von Meyer

1599 (Orig. No. 1020; B.S.N.H. 3485). Cushman, 1907, p. 272, as cotype, *errore*.

2000 (Orig. No. 1023; B.S.N.H. 3488). Cotype. Molasse. Unterkirchberg, near Ulm, Germany. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1848, p. 782, as *Rhombus kirchberganus*; 1851, p. 80; 1851a, p. 102, pl. XVII, fig. 3.

1596 (Orig. No. 1019; B.S.N.H. 3484). Plesiotype. Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1856, p. 25, pl. I, fig. 3; Cushman, 1907, p. 272, as cotype of *S. antiqua* von Meyer, *errore*.

1598 (Orig. No. 1022; B.S.N.H. 3487). Plesiotype. Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural His-

tory, 1925. Von Meyer, 1856, p. 26, pl. I, fig. 4, as *S. antiqua* von Meyer.

2005 (Orig. No. 1021; B.S.N.H. 3486). Plesiotype (holotype of *S. antiqua* von Meyer). Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1851, p. 80; 1851a, p. 103, pl. XVII, figs. 4, 5, 6, 7, as *S. antiqua* von Meyer; Cushman, 1907, p. 272, as cotype of *S. antiqua*, *errore*.

5212 (Orig. No. 1025; B.S.N.H. 3490). Plesiotype. Molasse. Unterkirchberg. Coll. Eser, through Boston Society of Natural History, 1925. Von Meyer, 1856, p. 26, pl. I, fig. 5, as *S. antiqua* von Meyer.

STETHACANTHUS DEPRESSUS (St. John and Worthen)

, Calhoun 5136. Plesiotype. Waverly sandstone. Marshall County, Mich. Coll. W. D. Gunning. Eastman, 1903b, p. 216, fig. 15 (poor figure); Hussakof, 1913, p. 249, footnote, and Hussakof and Bryant 1919, p. 170, footnote, as *S. humilis* Hussakof, *errore*.

STETHACANTHUS HUMILIS Hussakof

5136. Plesiotype. Hussakof, 1913, p. 249, footnote, *errore;* Hussakof and Bryant, 1919, p. 170, footnote, *errore;*

See STETHACANTHUS DEPRESSUS (St. John and Worthen).

SYMPHODUS SZAJNOCHAE (de Zigno)

5072. (Orig. Nos. 17, 18; formerly M.C.Z. 3078). Plesiotype. Eocene. Monte Bolca, near Verona, Italy. Coll. Krantz, 1903. Eastman, 1904, p. 29, pl. I, fig. 5.

SYNTHETODUS CALVINI Eastman

5098. Holotype. Upper Devonian (state quarry beds). North Liberty, Johnson County, Iowa. Coll. Calvin, 1896. Eastman, 1907b, pl. IV, fig. 15, p. 203, as Dipnoan dental plate, gen. et sp. nov.; 1908, p. 233, pl. II, fig. 19.

5099. Fifteen paratypes. State quarry beds. Johnson and Muscatine Counties, Iowa. Coll. Calvin, 1897. Eastman, 1908, p. 233, pl. XII, figs. 1–15.

TAENIODUS CONTORTUS St. John and Worthen

5137. Genoholotype. St. John and Worthen, 1883, p. 76.

See DELTODUS CONTORTUS (St. John and Worthen).

THELODUS MACINTOSHII Stetson

2035. Holotype. Upper Silurian. Cunninghams Mill Brook, Nerepis, New Brunswick. H. C. Stetson leg. and don., 1927. Stetson, 1928b, p. 223, fig. 1, p. 222.

2036, 2037. Two paratypes. Upper Silurian. Cunninghams Mill Brook, Nerepis, New Brunswick. H. C. Stetson leg. and don., 1927. Stetson, 1928b, p. 223, figs. 2-3, 4-6, p. 222.

THELODUS PLANUS Traquair

5217. Plesiotype. Ludlow. Logan Water, Lanarkshire, Scotland. H. C. Stetson leg. and don. Stetson, 1931, p. 148.

5250. Plesiotype. Ludlow. Logan Water. D. Tait leg. 1929. Stetson, 1931, p. 143, fig. 2A, p. 144.

THELODUS SCOTICUS Traquair

5255. Plesiotype. Ludlow. Logan Water, Lanarkshire, Scotland. H. C. Stetson leg. and don., 1928. Stetson, 1931, p. 142, figs. 1A, 1B.

THELODUS TAITI Stetson

5248. Paratype. Downtonian. Monks Burn, Lanarkshire, Scotland. D. Tait leg., 1929. Stetson, 1931, p. 143, figs. 1C, 1D, p. 142, and fig. 2C, p. 144.

5249. Paratype Downtonian. Monks Burn. D. Tait, P. E. Raymond, and H. C. Stetson leg., 1928. Stetson, 1931, p 143, fig. 1E, p. 142, and fig. 2B, p. 144.

TITANICHTHYS sp.

1301. Antero-ventro-median. Eastman, 1896, p. 47.
See DINICHTHYS TERRELLI Newberry.
1300. Postero-ventro-median. Eastman, 1896, p. 47.
See DINICHTHYS sp.
1475. Postero-ventro-median. Eastman, 1907b, p. 144. 1908, p. 205.
See under Dinichthyid.

TITANICHTHYS AGASSIZII Newberry

1297 (Orig. No. 1). Genoholotype. Cleveland shale. Sheffield, Ohio. Coll. J. Terrell, 1885. Newberry, 1885, p. 27; 1888, p. 13' genus only; 1899, p. 133, pl. I, pl. IV, fig. 4; Eastman, 1898, p. 761, fig. 4, p. 763.

Tristychius fimbriatus Stock

5201 (formerly M.C.Z. 4259). Holotype. Stock, 1883, p. 177, pl. VII, figs. 1, 1a.

See Harpacanthus fimbriatus (Stock).

Tristychius arcuatus Agassiz

5202 (formerly M.C.Z. 4255). Plesiotype. Lower Carboniferous (Calciferous). Carolina Park, Edinburgh, Scotland. Coll. T. Stock, 1883. Associated spine and axial skeleton. Stock, 1883, p. 180, pl. VII, fig. 8.

5203 (formerly M.C.Z. 4263). Plesiotype. Calciferous. Trinity, near Edinburgh. Coll. T. Stock, 1883. Four associated teeth. Stock, 1883, p. 183, pl. VII, fig. 12.

5204 (formerly M.C.Z. 4264). Plesiotype. Calciferous. Trinity. Coll. T. Stock, 1883. Tooth. Stock, 1883, p. 187, pl. VII, fig. 18.

5205 (formerly M.C.Z. 4265). Plesiotype. Calciferous. Hailes quarry, near Edinburgh. Coll. T. Stock, 1883. Tooth. Stock, 1883, p. 182, pl. VII, fig. 9.

5207. Plesiotype. Calciferous. Bathgate. Coll. T. Stock, 1883. Tooth. Stock, 1883, p. 183, pl. VII, fig. 11.

5208. Plesiotype. Calciferous. Hailes quarry. Coll. T. Stock, 1883. Tooth. Stock, 1883, p. 182, pl. VII, fig. 10.

5209 (formerly M.C.Z. 4261). Plesiotype. Calciferous. Hailes quarry. Coll. T. Stock, 1883. Spine. Stock, 1883, p. 184, pl. VII, figs. 13, 13a.

Vertebral centrum

5100. Upper Devonian (state quarry beds). Solon, Iowa. J. R. Hoats leg. and don., 1907. Eastman, 1908, p. 147, pl. XII, fig. 16.

Wardichthys cyclosoma Traquair

5246 (formerly M.C.Z. 3378). Plesiotype. Lower Carboniferous (Calciferous). Wardie, Edinburgh, Scotland. Coll. T. Stock, 1883. Stock, 1881, p. 490.

Xiphotrygon acutidens Cope

2038. Genoholotype. Eocene (Green River shales). Twin Creek, Bear River region, southwestern Wyoming. L. A. Lee leg., A. Agassiz don., 1910. Cope, 1879, p. 333; 1884, pp. 49–51, pl. I, figs. 1–5.

REPTILES AND AMPHIBIANS

Alligator prenasalis (Loomis)

1014 (formerly M.C.Z 21699). Plesiotype. Oligocene (White River Titanotherium beds). Little Corral Draw, near Scenic, S. Dak. H. and E. Schlaikjer leg., 1925. T. Barbour don. Incomplete skeleton. Barbour, 1926, pp. 109–111. Mook, 1932, pp. 19–41; pl. 1–3.

1015. Plesiotype. Oligocene (White River Titanotherium beds). Little Corral Draw, near Scenic, S. Dak. H. and E. Schlaikjer leg., 1925. T. Barbour don. Skull and jaws with a few other bones. Barbour, 1926, pp. 109–111. Mook, 1932, pp. 19–41; ~~pl. 1–3.~~

Archaeophis bolcensis Massalongo

1001, 1002 (Orig. Nos. 11, 12). Two cotypes. Eocene. Monte Bolca, near Verona, Italy. Coll. Canossa, through Krantz, 1903. Massalongo, 1859, pp. 15–16, pl. III, IV; Janensch, 1906, pp. 17–18.

1003 (Orig. No. 13). Cotype. Eocene. Monte Bolca. Coll. Canossa, through Krantz, 1903. Massalongo, 1859, pp. 15–16; Janensch, 1906, pp. 17–18.

Baphetes minor Dawson

1053. Holotype. Carboniferous. Vicinity of Joggins, Nova Scotia. H. A. Morrell leg. Mrs. E. M. Hooper don. Exterior of right mandible. Dawson, 1870, p. 166; 1870a, p. 87; 1870b, p. 99.

Batrachichnus plainvillensis Woodworth

1052. Genoholotype. Pennsylvanian. Plainville, Mass. J. B. Woodworth leg., 1899, et don., 1917. Woodworth, 1900, pp. 452–453, text fig. 2, pl. XL, fig. 1.

The indeterminate scratches mentioned by Woodworth (1900, p. 454, pl. XL, fig. 2) are also in the collection.

Belodon planirostris von Meyer

1018 (Orig. No. 4361; B.S.N.H. 7512). Cotype. Triassic (Stubensandstein). Aixheim, near Spaichingen, Württemberg, Germany. Coll. Eser, through Boston Society of Natural History. Fragmentary skull. Von Meyer, 1863, pp. 241–244, pl. XLI, figs. 1–3, and pl. XLII, fig. 7.

1019 (Orig. No. 4369; B.S.N.H. 7520). Three cotypes. Stubensandstein. Aixheim. Coll. Eser, through Boston Society of Natural History. Snout fragments. Von Meyer, 1863, p. 243, pl. XLI, figs. 4–9, and pl. XLII, fig. 7 (only 1019–A and 1019–B figured).

1020 (Orig. No. 4365; B.S.N.H. 7516). Cotype. Stubensandstein. Aixheim. Coll. Eser, through Boston Society of Natural History. Dermal scute. Von Meyer, 1863, p. 244. pl. XLI, figs. 10–11.

1021 (Orig. No. 4364; B.S.N.H. 7515). Cotype. Stubensandstein. Aixheim. Coll. Eser. through Boston Society of Natural History. Left femur. Von Meyer, 1863, p. 241.

1022 (Orig. No. 4367; B.S.N.H. 7518). Two cotypes. Stubensandstein. Aixheim. Coll. Eser, through Boston Society of Natural History. Skull fragments. Von Meyer, 1863, p. 244.

1023 (Orig. No. 4362; B.S.N.H. 7513). Cotype. Stubensandstein. Aixheim. Coll. Eser, through Boston Society of Natural History. Dermal scute. Von Meyer, 1863, p. 244.

This is the type species of Mystriosuchus E. Fraas, 1896.

Carolinochelys wilsoni Hay

1005 (Orig. No. 13640; formerly M.C.Z. 20300). Genoholotype. Eocene (Ingleside marl). Vicinity of Charleston, S. C. Coll. R. Wilson. T. Barbour don., 1924. Skull, humerus. Hay, 1923, pp. 119–120; 1923a, pp. 29–31, pls. II, III.

Chonespondylus grandis Leidy

1049. Genoholotype. Leidy, 1868, p. 178.

See Cymbospondylus petrinus Leidy.

Crocodylus robustus Vaillant and Grandidier

1006. Plesiotype. Pleistocene. Antsirabé, Madagascar. F. R. Wulsin leg. and don., 1917. Skull. Barbour, 1918, p. 488, pl. I, figs. 1–3.

Cyclura sp.

1016. Two jaws, one maxilla. Barbour, 1917, p. 98.

See Cyclura portoricensis Barbour.

Cyclura portoricensis Barbour

1008 (formerly M.C.Z. 12460). Holotype. Pleistocene. Ciales Cave, Porto Rico. G. M. Allen and J. L. Peters leg., T. Barbour don.,

1917. Left humerus (shaft missing). Barbour, 1919, p. 146, pl. I, figs. F, G; Barbour and Loveridge, 1929, p. 249.

1009–1013 (formerly M.C.Z. 16870–16874). Five paratypes. Pleistocene. Ciales Cave, Porto Rico. G. M. Allen and J. L. Peters leg., T. Barbour don., 1917. Left femur, tibia, ulna, right ulna, first sacral vertebra. Barbour, 1919, p. 146, pl. I, figs. A–E; Barbour and Loveridge, 1929, p. 249, referring to 1010 (formerly 16871) only.

1016. Three paratypes. Pleistocene. Ciales Cave, Porto Rico. G. M. Allen and J. L. Peters leg., T. Barbour don., 1917. Two jaws, one maxilla. Barbour, 1917, p. 98, as Cyclura sp.; 1919, pp. 145, 146.

1017. Nine paratypes. Pleistocene. Ciales Cave, Porto Rico. G. M. Allen and J. L. Peters leg., T. Barbour don., 1917. Fragmental bones. Barbour, 1919, p. 146.

Cymbospondylus grandis (Leidy)

1049. Holotype. Merriam, 1902, pp. 106–107. pl. XVI, fig. 3. See Cymbospondylus petrinus Leidy.

Cymbospondylus petrinus Leidy

1044 (Orig. Nos. 68–72). Holotype. Middle Triassic. Humboldt. Nev. Coll. J. D. Whitney, 1896. Three fragmentary vertebrae and two plugs. Leidy, 1868, p. 178; Merriam, 1902, p. 106, pl. XVI, figs. 4, 5. The figure is of No. 1044-E (Orig. No. 72).

1049 (Orig. No. 23). Plesiotype (genoholotype of *Chonespondylus grandis* Leidy). Middle Triassic. Star Canyon, Humboldt County, Nev. Coll. J. D. Whitney, 1896. Fragmentary centrum. Leidy, 1868, p. 178, as *Chonespondylus grandis* Leidy; Merriam, 1902, pp. 106–107, pl. XVI, fig. 3, as *Cymbospondylus grandis* (Leidy); 1908, p. 104.

Cymbospondylus piscosus Leidy

1045 (Orig. No. 73). Genoholotype. Middle Triassic. New Pass, Toiyabe Range, Nev. Coll. J. D. Whitney, 1896. Five fragmentary associated vertebrae. Leidy, 1868, p. 177; Merriam, 1902, pp. 104–105, pl. XVI, figs. 1, 2; 1908, pp. 104, 123–124, figs. 136, 137.

1047 (Orig. No. 73a). Genoparatype. Middle Triassic. Star Canyon, Humboldt County, Nev. Coll. J. D. Whitney, 1896. Nine fragmentary associated centra. Leidy, 1868, p. 177.

1048 (Orig. No. 73b). Genoparatype. Middle Triassic. Reese River, Toiyabe Range, Nev. Coll. J. D. Whitney, 1896. Vertebral centrum. Leidy, 1868, p. 178.

Perhaps these specimens should be called cotypes; in view of Leidy's wording, and since Merriam took No. 1045 as the lectotype, they are listed as above.

Dromopus? woodworthi Lull

1050. Holotype. Pennsylvanian. Attleboro, Mass. F. Garnjost leg., 1916. J. B. Woodworth don. Lull, 1920, pp. 234–236, fig. 1.

Homoeosaurus maximiliani von Meyer

1004. Plesiotype. Upper Jurassic. Solenhofen, Bavaria, Germany. Coll. Haeberlein, 1882. Shows squamation. Barbour and Stetson, 1929, pp. 99–104, pl. I, figs. 1–2.

Liodon proriger Cope

Holotype. Cope, 1870, pp. 202–205, pl. XII, figs. 22–24; 1875, pp. 161–166, pl. XXX, figs. 10–14.
See Tylosaurus proriger (Cope).

Machaeroprosopus lithodendrorum Camp

1029 (Orig. No. 7034/26719). Paratype. Triassic (Lower Chinle). Carrizo Wash, near Adamana, Ariz. Exch. University of California, 1931. Skull lacking rostrum. Camp, 1930, pp. 19, 26, 27, 29, 30, 46–47, figs. 2a. 3d, 4c, 6, 13.

Macrosaurus proriger Cope

Holotype. Cope, 1869, p. 123; 1869a, pp. 121–122.
See Tylosaurus proriger (Cope).

Mystriosuchus planirostris (von Meyer)

1018–1023. Nine genocotypes.
See Belodon planirostris von Meyer.

Plesiosaurus longirostris Blake

1033. Holotype. Upper Lias. Whitby, Yorkshire. Brown-Marshall leg. Exch. Tufts College, 1931. Skeleton. Blake, 1876, p. 250–252, pl. I, fig. 6, and pl. III, fig. 2.

Rana jägeri von Meyer

1007 (Orig. No. 479; B.S.N.H. 2765). Holotype. Miocene. Haslach, near Ulm, Germany. Coll. Eser, through Boston Society of Natural History, 1925. Jäger, 1850, p. 822, pl. LXXII, fig. 63 (recomposed figure), as a mole; von Meyer, 1851, p. 78; 1860, p. 144, pl. XXII, fig. 5.

Von Meyer hints (1860, p. 144) that Jäger had only the counterpart of our specimens; Jäger's figure does not bear him out.

Tylosaurus proriger (Cope)

Holotype. Cretaceous (Niobrara). Near Monument, Kans. Colonel Connyngham and Mr. Minor leg. and don. Cope, 1869, p. 123, and 1869a, pp. 121–122, as Macrosaurus; 1870, pp. 202–205, pl. XII, figs. 22–24, and 1875, pp. 161–166, pl. XXX, figs. 10–14, as Liodon.

This specimen was apparently never returned by Cope; nothing has been learned of its present whereabouts.

BIRDS

Accipitrid, gen. et sp. ind.

2219. Lower Miocene. Stenomylus quarry, Agate, Nebr. E. M. Schlaikjer leg., 1929. T. Barbour don. Broken right ulna, pedal phalanx, broken vertebra. Wetmore, 1930, p. 152.

Branta canadensis hutchinsi (Richardson)

2226. Plesiotype. Pleistocene. Melbourne, Fla. C. P. Singleton leg., 1928. T. Barbour don. Right humerus. Wetmore, 1931, p. 19.

Carinate contour feather

2218 (formerly M.C.Z. 5199). Eocene. Monte Bolca, near Verona, Italy. Coll. Canossa, through Krantz, 1903. Eastman, 1904a, pp. 669–672, fig., p. 671.

Casmerodius albus (Linnaeus)

2224. Plesiotype. Pleistocene. Melbourne, Fla. C. P. Singleton leg., 1928. T. Barbour don. Right ulna. Wetmore, 1931, p. 15.

Cathartes aura septentrionalis Wied

2229. Plesiotype. Pleistocene. Melbourne, Fla. C. P. Singleton leg., 1928. T. Barbour don. Distal end of left ulna. Wetmore, 1931, p. 24.

Gallinuloides wyomingensis Eastman

2221 (formerly M.C.Z. 1598). Genoholotype. Eocene (Green River shales). Fossil, Wyoming. D. C. Haddenham leg., 1899. Eastman, 1900, pp. 55–57, pl. IV; Lucas, 1900, pp. 79–84, text fig. and pl. I; Shufeldt, 1915, pp. 619–634, figs. 1, 2.

Shufeldt's generic name "Palaeobonasa" (1915, p. 633) is invalid; unfortunately, it has been accepted by Lambrecht (1916, pp. 234, 296, 495, and 1921, p. 80).

Grus americana (Linnaeus)

2228. Plesiotype. Pleistocene. Melbourne, Fla. C. P. Singleton leg., 1929. T. Barbour don. Distal part of left ulna. Wetmore, 1931, p. 35.

Haliæetus leucocephalus (Linnaeus)

2232. Plesiotype. Pleistocene. Melbourne, Fla. C. P. Singleton leg., 1928. T. Barbour don. Part of right metacarpus. Wetmore, 1931, p. 30.

Jabiru mycteria (Lichtenstein)

2225. Pleisotype. Pleistocene. Melbourne, Fla. C. P. Singleton leg., 1929. T. Barbour don. Fragments of right tarsometatarsus, and three right and two left tibiotarsi. Wetmore, 1931, p. 17.

Meleagris gallopavo Linnaeus

2231. Plesiotype. Pleistocene. Melbourne, Fla. C. P. Singleton leg., 1928. T. Barbour don. Parts of left humerus, right tibiotarsus, and right tarsometatarsus. Wetmore, 1931, p. 33.

Palaealectoris incertus Wetmore

2190. Genoholotype. Lower Miocene. Agate Springs, Nebr. E. M. Schlaikjer leg., 1928. T. Barbour don. Left humerus (distal part of shaft missing). Wetmore, 1930, pp. 152–153, figs. 51–53.

Palaeobonasa wyomingensis (Eastman)

2221. Genoholotype. Shufeldt, 1915, p. 633.
See Gallinuloides wyomingensis Eastman.

Palaeospiza bella Allen

2222. Genoholotype. Miocene. Florissant, Colo. S. H. Scudder leg., 1877. Exch. Boston Society of Natural History. Allen, 1878, pp. 443–445, pl. I, fig. 1; 1878a, pp. 381–384, fig. 1; 1878b, pp. 204–205, fig. 1; Wetmore, 1925, pp. 183–191, text figures 1, 2, and pls. I–IV.

The original of Figure 2 in Allen's papers (cf. also Wetmore, 1925, p. 185) has not been found. – found 1932 by H.C.S.

Palapteryx major Kneeland

2220 (B.S.N.H. 10611). Cotype. Pleistocene. New Zealand. Coll. H. B. Cross. Exch. Boston Society of Natural History. Metatarsus. Kneeland, 1852, pp. 236–238; 1853, pp. 298–299.

The femur, tibia, and phalanges mentioned by Kneeland cannot be located in the collections.

Paractiornis perpusillus Wetmore

2191. Genoholotype. Lower Miocene. Carnegie Hill, Agate, Nebr. E. M. Schlaikjer leg., 1929. Left tarsometatarsus. Wetmore, 1930, pp. 153–154, figs. 54–56 (the figures are x 2, not natural size as noted).

Querquedula floridana Shufeldt

2227. Plesiotype. Pleistocene. Melbourne, Fla. C. P. Singleton leg., 1928. T. Barbour don. Proximal part of right humerus. Wetmore, 1931, p. 22.

Struthiolithus chersonensis Brandt

2223 (formerly M.C.Z. 1597). Plesiotype. Pleistocene. Yao Kuan Chuang, ca. 50 miles southwesterly of Kalgan, China. Coll. W. P. Sprague, 1898. Eastman, 1898a, pp. 127–135, pl., figs. 1, 2.

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By James C. Greenway, Jr.

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February, 1933

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No. 5.— *Birds from Northwest Yunnan*

By James C. Greenway, Jr.

Dr. Joseph F. Rock returned to the United States for a short visit after having made his fine collections for the United States National Museum. He returned to China to collect for the Museum of Comparative Zoölogy. This is a report of the birds that have been sent to the Museum by him in the years 1931 and 1932.

Upon his arrival at Yunnan-fu, capital of the westernmost province of China, in August, he found that the provincial government had long been at war with the neighboring province of Kwang-tung, that three thousand men had been sent to the war, and that in consequence the country had been left to the mercy of bandits. For this reason it was considered unsafe to proceed up country and a long delay followed. So it was not until January that he was able to lead his caravan of thirty-five mules over the long but to him familiar trail to the northwest.

In about three weeks the expedition arrived at Likiang, seat of the district government, but they found that the Nah-si population were in the process of celebrating the festival of muan-mo (propitiation of heaven) and would do no work. After more delay the caravan with a guard of a few ill-armed soldiers, trailed off to the northwest, into the valley of the Mekong and later northward into the valley of the Salween and the headwaters of the Irrawaddy.

The expedition was divided, and real collecting began in April and continued until March of the next year. I have listed the localities where Rock collected together with the meager information that he has furnished.

A-dshwa, eastern slopes of the Likiang Snow Range, 14,500 ft., crags and cliffs, May, 1931.

Champutong, border of Tibet and Yunnan, Salween Valley, eastern slopes of the Salween-Irrawaddy Divide, 9,000 to 10,000 ft., July.

Chou-yu-gko, above Tao-mung-chung, Likiang District, 13,000 to 15,000 ft., eastern slopes of the Yangtze-Mekong Divide, fir and rhododendron forest, April, 1931.

Gomba-la, Mt. (Kenichunpo), eastern slopes of the Salween-Irrawaddy Divide, 14,000 to 16,000 ft., alpine meadows and rocky crags and also fir and rhododendron forest, July, 1931.

Gyi-na-loko, Mt., Likiang Snow Range, 10,000 to 15,000 ft., October or November, 1931.

Haba-ndsher-nvulu Snow Range, northwest of the Yangtze big bend, above 14,000 ft., fir and spruce forests with Arundinaria undergrowth, January, 1932.

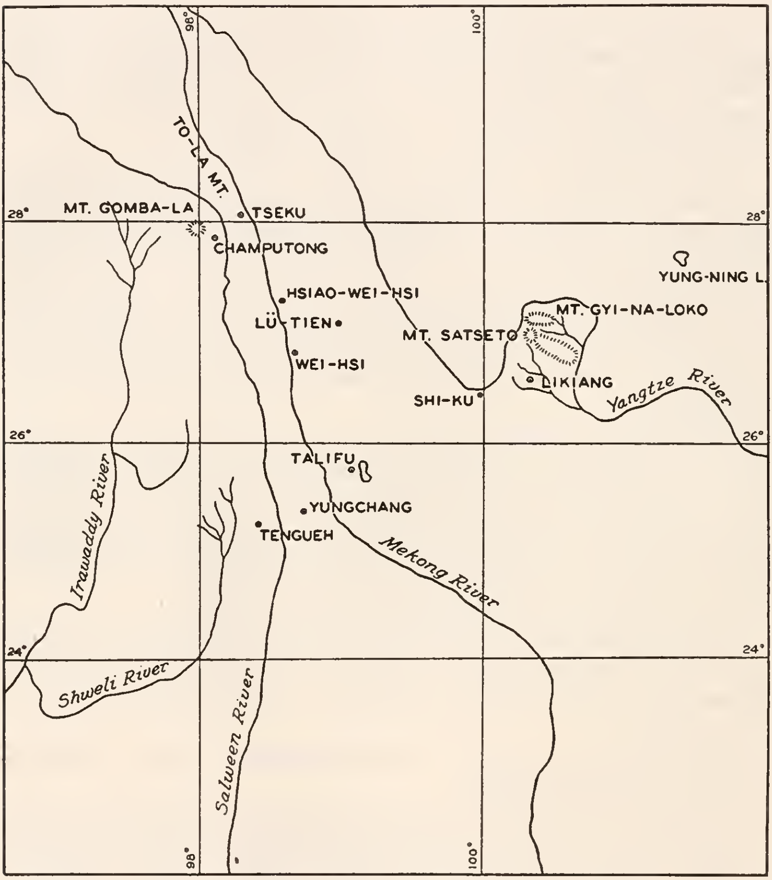

FIG. 1

Hsiao-Wei-hsi, north of Wei-hsi, banks of the Mekong River, September, 1931.

Kenichunpo, Mt. (see Mt. Gomba-la).

La-shi-pa, west of Likiang, rice fields, September, 1931.

Na-dza-gko, alpine meadow of, slopes of Mt. Satseto.

Ny-lu-ko, foot of the Likiang Snow Range, 9,500 ft., July, 1931.

Satseto, Mt., east slopes of the Likiang Snow Range, 12,000 to 15,000 ft., limestone formation; spruce and fir forests mixed with Acer, Syringa, Euonymus, Arundinaria, October and November, 1931.

Shi-ku, banks of the Yangtze River, 6,200 ft., willow and poplar groves, March, 1931.

Shwe-men-kan, Mt., Haba-ndsher-nvulu Snow Range.

Su-wa-tong, Tibet, 14,000 to 16,000 ft., upper slopes of Mt. Gomba-la or Kenichunpo, July, 1931.

Tao-mung-chung, southwest of Lu-tien (Li-tien), Likiang District, 10,000 to 12,000 ft., southern slopes of the Yangtze-Mekong Watershed (Li-ti-ping), spruce and fir forests, April and May, 1931.

Tse-chung, Mts., Mekong Valley, eastern slopes of the Mekong-Salween Divide, 8,000 to 11,000 ft., forests, August and September.

Tung-la, Mts. (To-la in Tibetan), above Ho-fu-ping, western slopes of the Yangtze-Mekong Divide (Pe-ma-shan), 12,000 to 14,000 ft., fir and rhododendron forests, August, 1931.

Wei-hsi, west of, 9,000 ft., pine forests, June, 1931.

Wei-hsi, Mts., west of, east of the Mekong River, 10,000 to 11,000 ft., spruce and hemlock forests with canebrake undergrowth, June, 1931.

Wei-hsi, banks of the Wei-hsi River, 7,000 ft., June, 1931.

Yun-nan-yi, plain of, east of Talifu, 5,000 ft., February, 1931.

Yung-ning, Lake, two days northeast of the Yangtze big bend, spruce forests with canebrake undergrowth, 10,000 ft., February, 1932.

The collection contains over 1,800 skins, comprising 216 forms. It is a well made collection, without overburdening series of common things and with its share of rarities. *Chalcites xanthorhynchus* has been added to the Yunnan list and three forms have been described. They are *Erythrina edwardsii rubicunda*, *Erythrina vinacea rubidior* and *Ithaginis cruentus holoptilus*.

Thanks are due to the United States National Museum for the loan of needed material and to Joseph H. Riley, N. B. Kinnear of the British Museum of Natural History and B. Stegmann of the Academy of Science, Leningrad, for advice.

It would be impossible adequately to thank Outram Bangs and James L. Peters. Since the report was done under their constant kindly supervision, their work merges subtly into mine, so that it would be impossible to say where one began and the other ended. During the period in which the collection was being identified Outram

Bangs died. I cannot express the value of his influence and help not only to this little paper but also to my education.

Phasianus colchicus elegans Elliot

Ann. Mag. Nat. Hist., **6**, 1870, p. 312 (Yung-ling Mountains, W. Sechuan).

A single male was taken on the slopes of Mt. Gyi-na-loko in April; three males at Tao-mung-chung in April or May and a female from the mountains of Tung-la (To-la) in August.

Chrysolophus amherstiae (Leadbeater)

Phasianus amherstiae Leadb., Trans. Linn. Soc. London, **16**, 1828, p. 129, pl. 15 (Mountains of Cochin China).

Five mature males, two immature and two females were taken at Tao-mung-chung in April or May; an immature male at Mt. Satseto in December; a female at Mt. Gyi-na-loko in October or November, and another female at an unnamed locality in the Likiang Range in March, and two males at A-dshwa in May.

Pucrasia meyeri Madrasz

Ibis, 1886, p. 145 (Central Tibet).

Single males come from Tao-mung-chung (April or May), Mt. Gyi-na-loko (October or November), and three males and a female from the Likiang Snow Range (February).

Tetraophasis szechenyii Madrasz

Zeitschr. Ges. Orn., **2**, 1885, p. 50, pl. 2 (East Tibet).

Four males and six females were taken on the Likiang Snow Range in February and three males and a single female at Mt. Gyi-na-loko on the Likiang Range in October or November.

Crossoptilon crossoptilon (Hodgson)

Phasianus crossoptilon Hodgson, Journ. Asiat. Soc. Bengal, **7**, 1838, p. 864, pl. 46 (Tibet).

A male and three females were taken at Mt. Satseto in February.

Verreaux mentions three characters to distinguish his *drouynii* (*tibetanus*). They are (1) grayish-white remiges instead of brown, (2) outer rectrices which lack white spots and (3) the median rectrices narrower and without the green-gold tinge.

In a series of three pairs taken by Zappey in southwest Sechuan in July and August the primaries are distinctly brownish while those of our present series are grayish. In males of both series the white outer webs of the outer primaries are apparent. I conclude that the primaries of summer birds are faded to brown and that the white on the outer primaries is a variable sex character.

I have not seen any specimens from central Tibet so that I cannot tell about the relative amount of white on the outer rectrices nor the relative width of the middle feathers. In the series of the Museum of Comparative Zoölogy a single male from Sechuan has the outer tail feathers edged with gray as has the single male from the Likiang Range, Yunnan. In view of these facts it would seem doubtful that *drouynii* is a tenable form.

Tragopan temmincki (Gray)

Satyra temmincki Gray, in Hardwicke's Ill. Ind. Zoöl., **1**, 1830–32, pl. 1 (China).

Rock sent a single mature male from Shwe-men-kan (January); two females from Mt. Gyi-na-loko, one taken in November and the other in April; an immature male and two females from Mt. Satseto (December), and an immature male and two females from Chou-yugko (April).

Ithaginis cruentus kuseri Beebe

Zoölogica, **1**, 1912, p. 190 (Yunnan).

A single male specimen was taken at Mt. Gomba-la or Kenichunpo in southeast Tibet, elevation 14,000 to 16,000 ft., in June.

Ithaginis cruentus holoptilus subsp. nov.

Type.—No. 160,786 Museum of Comparative Zoölogy from Chou-yugko, above Tao-mung-chung, Likiang District; east slopes of the Yangtze-Mekong Divide, 13,000 to 15,000 ft., collected in April, 1931.

Characters. Intermediate between *Ithaginis c. kuseri* Beebe and *Ithaginis c. rocki* Riley. On comparison with *rocki* the lores will be found to be black and red instead of black, and the same difference will be found in the line above the eye; the sides of the neck are white narrowly edged with gray rather than gray with narrow white shaft lines; sides of the upper breast are red and green rather than red mixed with buffy, or buffy. The chief character upon which I have separated this subspecies is the texture of the feathers of the crest, which are normal rather than decomposed as in *clarkei*, *rocki* and *kuseri*.

Rock has sent three males and three specimens sexed as females. I think, however, that two of these are immature males since they have red feathers appearing on the neck and breast; all of these were taken at Chou-yu-gko, Likiang District.

The range of these subspecies is, of course, very imperfectly known. As far as is known, however, this new form has an intermediate range. *Kuseri*, according to Rothschild, has been taken from Tseku, where its range borders on that of *rocki*, the Salween Valley, Tengueh and the Shweli-Salween Divide; *rocki* to the north in the mountains of Ho-fu-ping, and *clarkei* in the Likiang Mountains to the westward.

As well as a single specimen of *Ithaginis c. clarkei* Roths., taken at the Likiang mountains in May, I have examined two males and a female of *clarkei* from the same locality, kindly loaned by the United States National Museum, as well as two males and a female of *Ithaginis c. rocki* from the Ho-fu-ping mountains.

Ithaginis cruentus clarkei Rothschild

Bull. B. O. C., **40**, 1920, p. 67 (Likiang Range, Yunnan).

Ten males were taken at Mt. Satseto in January and February and one at Gyi-na-loko in October or November, two from Shwe-men-kan (January) and one at A-dshwa in May. Six females come from Mt. Satseto (January or February), one from Mt. Gyi-na-loko (October or November) and one from Shwe-men-kan (January).

Amaurornis fuscus erythrothorax (Temminck & Schlegel)

Gallinula erythrothorax T. & S., Siebold's Faun. Jap., Aves, 1849, p. 121 (Japan).

Seven males, six females and one unsexed specimen were taken on the banks of the Wei-hsi River in June.

Males measure wing: 98–107 and females 106–108.

Sphenocercus sphenurus yunnanensis La Touche

Bull. B. O. C., **42**, 1921, p. 13 (Lotukow, Yunnan).

Four males come from the mountains of Tung-la (To-la) (August).

Columba leuconota gradaria Hartert

Novit. Zoöl., **23**, 1916, p. 85 (Szetchuan).

Rock has sent a single specimen without data.

	CLARKEI	KUSERI	HOLOPTILUS	ROCKI
Lores	Black	Black and Red	Black and Red	Black
Above the eye	Black	Black	Black and Red	Black
Ear coverts	Very long, decomposed feathers; white shaft lines often tinged with red and black at base	Black	Long decomposed feathers; white shaft lines sometimes tinged with red and buff; black edges	Long (shorter than in *clarkei*) decomposed feathers; white shaft lines, edged with black
Crest	Very long; feathers decomposed	Short; feathers decomposed	Short; normal feathers	Short; decomposed feathers
Sides of neck	Gray with buffy shaft lines	Black	White, narrowly edged with gray	Gray with white shaft lines
Sides of upper breast	Gray with buffy shaft lines	Black	Red and green	Red mixed with buffy or buffy
Wing	♂ 202–214 ♀ 185–208	♂ 195	♂ 202–206 ♀ 196	♂ 196–199 ♀ 183

Streptopelia orientalis orientalis (Latham)

Columba orientalis Latham, Ind. Orn., **2**, 1790, p. 606 (China).

Two males and a female come from Tao-mung-chung (April or May), a single male from west of Wei-hsi (June) and a male without data.

Eulabeia indica (Latham)

Anas indica Latham, Ind. Orn., **2**, 1790, p. 839 (India in winter and Tibet).
Anser indicus, Stuart Baker, Faun. Brit. Ind., ed. 2, **4**, 1929, p. 405.

A female and an unsexed specimen were shot on the plain of Yunnan-yi, east of Talifu in February.

Ardea cinerea jouyi Clark

Proc. U. S. Nat. Mus., **32**, 1907, p. 468 (Seoul, Corea).

One female was taken at La-shi-pa, west of Likiang in rice fields in September. This is clearly a white necked form although the skin is in rather poor condition.

Bulbulcus ibis coromandus (Boddaert)

Cancroma coromanda Boddaert, Tabl. Pl. Enl., 1783, p. 54 (Coromandel).

A male in breeding plumage comes from Tao-mung-chung in April or May.

Milvus lineatus (Gray)

Haliaëtus lineatus Gray, Ill. Ind. Zoöl., **1**, 1832, p. 1, pl. 18 (China).

One unsexed specimen, a female, comes from the Likiang Snow Range (February).

Accipiter virgatus affinis Hodgson

Bengal Sport. Mag., New Ser., **8**, 1836, p. 179 (Nepal).

Rock has sent what by its very dark coloration appears to be an immature female from the Likiang Snow Range (April).

Buteo burmanicus burmanicus Hume

Stray Feath., **3**, 1875, p. 30 (Thayetmyo, Burma).

Two males come from the Likiang Snow Range (eastern slopes) and were taken in February.

Spizaetus nipalensis nipalensis (Hodgson)

Nizaëtus nipalensis Hodgson, Journ. Asiat. Soc. Bengal, **5**, 1836, p. 229, pl. 7 (Nepal).

A single specimen sexed as a female was taken at Mt. Gyi-na-loko in April. The wing measures 455 mm. It is an immature bird.

Aquila nipalensis nipalensis Hodgson

Asiat. Researches, **18**, pt. 2, 1833, p. 13, pl. 1 (Nepal).

One female comes from the foot of the Likiang Snow Range, 9,400 ft. (March).

Falco tinnunculus japonensis Ticehurst

Bull. B. O. C., **50**, 1929, p. 10.
Falco tinnunculus japonicus Temminck and Schlegel, in Siebold's Faun. Jap., Aves, 1844, p. 2, pl. 1 (Japan). [Name preoccupied.]

An immature male and female come from Mt. Gyi-na-loko (October or November).

Glaucidium cuculoides whiteleyi (Blyth)

Athene whiteleyi Blyth, Ibis, 1867, p. 313 (China).

A single female was taken at Shi-ku, on the banks of the Yangtze in March. This bird appears to be somewhat darker than a long series from Sechuan, Hupeh and Fukien in the Museum of Comparative Zoölogy.

Strix nivicola (Blyth)

Syrnium nivicolum Blyth, Journ. *Asiat.* Soc. Bengal, **14**, 1845, p. 185 (Himalayas).

A single male specimen was taken at Chou-yu-gko in April.

Bangs,[1] La Touche,[2] Rothschild[3] and Stuart Baker[4] seem to be agreed that *S. aluco harterti* La Touche and *Strix nivipetens* Riley are synonyms of *nivicola*: that the wide individual variations of these owls cannot be grouped in any way in order to show that there is a race of the Indian bird in China. I have followed Bangs in keeping *nivicola* specifically distinct until there is more evidence that will point to its affinities with *aluco*.

[1] Bull. Mus. Comp. Zoöl. Harvard, **70**, No. 4, 1930, p. 197.
[2] Birds of East. China, **2**, pt. 2, 1932, p. 109.
[3] Novit. Zoöl., **33**, 1926, p. 233.
[4] Faun. Brit. Ind., **4**, 1927, p. 399.

Chalcites xanthorhynchus (Horsfall)

Cuculus xanthorhynchus Horsfall, Trans. Linn. Soc. **13**, pt. 1, 1821, p. 179 (Java).

A single female was taken north of Wei-hsi on the Mekong in September. This is the first record of this bird for Yunnan. It is, of course, surprising that it has never been taken before, but since it is known to breed in Assam it is not incredible.

Cuculus canorus bakeri Hartert

Vög. Pal. Faun., **2**, 1912, p. 948 (Shillong, Khasia Hills).

Rock has sent a series of eight mature birds, a male from Tao-mung-chung (April or May), two males, three females and two unsexed specimens from Chou-yu-gko (April).

Two birds just from the nest were taken at Champutong in July. These specimens have the exposed portion of the wing barred with brown.

Cuculus optatus optatus (Gould)

Proc. Zoöl. Soc. London, 1845, p. 18 (Port Essington, Australia).

A single male in juvenal plumage was shot in the mountains of Tse-chung in August or September.

Cuculus poliocephalus poliocephalus Latham

Ind. Orn., **1**, 1790, p. 214 (Srinagar).

Two males come from Chou-yu-gko (April), a female from Champutong (July) and an unsexed specimen from the mountains of Tse-chung (August or September).

Megalaema virens virens (Boddaert)

Bucco virens Bodd., Tabl. Pl. Enl., 1783, p. 53 (China).

An unsexed immature specimen was taken at Champutong in July.

Picumnus innominatus chinensis (Hargitt)

Vivia chinensis Harg., Ibis, 1881, p. 228, pl. 7 (May-chee, China).

A single male was taken in canebrake at Tao-mung-chung in April or May.

Macropicus forresti (Rothschild)

Dryocopus forresti Roths., Bull. B. O. C., **43**, 1922, p. 9 (Mekong Valley, Yunnan).

A female was taken at Tao-mung-chung in April or May and another at Chou-yu-gko in April. An unsexed specimen comes from the mountains of Tung-la (To-la) in August.

Picoides funebris Verreaux

Nouv. Arch. Mus. Paris, Bull., **6**, 1870, p. 33 (Mountains of Chinese Tibet).

An unsexed specimen comes from the mountains of Tung-la (To-la) (August), a male and an unsexed specimen from Mt. Gyi-na-loko (October or November), a female from Mt. Satseto (February) and two males and a female from Shwe-men-kan (January).

Dryobates nanus omissus (Rothschild)

Dryobates pygmaeus omissus Roths., Bull. B. O. C., **43**, 1922, p. 10 (Likiang Range).

A pair comes from Shwe-men-kan (January) and a single female from Mt. Satseto (February).

These specimens are larger than *Dryobates obscurus* La Touche (wing 104–106–103) and are somewhat less heavily striped and more buffy. This accords very well with the original description. Rothschild has emended his own description [1] and finds that *omissus* differs from *obscurus* only in its larger size.

Dryobates hyperythrus hyperythrus (Vigors)

Picus hyperythrus Vigors, Proc. Zoöl. Soc. London, pt. 1, 1831, p. 23 (Himalayan Mountains).

A male, a female and an unsexed specimen come from Tao-mung-chung (April or May), a pair from Chou-yu-gko (April), a female from Mt. Gyi-na-loko (October or November) and a female from Mt. Satseto (February).

I have followed Rothschild in referring this series to the Indian form. There seems to be no tinge of the dull brown with its lack of red that is characteristic of *subrufinus*, nor is the back whiter than in Indian birds.

[1] Novit. Zoöl., **33**, 1926, p. 238.

Dryobates darjellensis desmursi (Verreaux)

Picus desmursi Verr., Nouv. Arch. Mus. Paris, Bull., **6**, 1870, p. 33 (Mountains Chinese Tibet).

A female comes from Tao-mung-chung (April or May), a female, an unsexed specimen and an immature bird, sexed as a female, from the mountains of Tung-la (To-la) (August).

Dryobates major stresemanni Rensch

Zoöl. Erg. W. Stotz. Exp., in Abh. und Ber. Mus. Dresden, **16**, 1924, no. 2, pt. 3, p. 38 (Tsalila).

Two males and a female were taken at Tao-mung-chung in April or May, a single female at Chou-yu-gko in April, two females at Mt. Gyi-na-loko (October or November) and a male and two females at Mt. Satseto in February.

Picus canus sordidior (Rippon)

Gecinus sordidior Rippon, Bull. B. O. C., **19**, 1906, p. 32 (W. Yunnan).

Two males were taken at Tao-mung-chung in April or May, a single female west of Wei-hsi in June, an unsexed specimen in the mountains of Tung-la (To-la) in August, and a female at Mt. Gyi-na-loko in October or November.

Psittacula schisticeps finschi (Hume)

Palaeornis finschi Hume, Stray Feath., **2**, 1874, p. 509 (Kollidoo).

A male was taken at Shi-ku on the banks of the Yangtze in March and an immature male at Nv-lu-ko at the foot of the Likiang Snow Range in July.

Psittacula derbyana (Fraser)

Palaeornis derbyanus Fraser, Proc. Zoöl. Soc. London, 1850, p. 245, pl. 25 (No locality).

A male comes from Na-dza-gko, eastern slopes of Mt. Gyi-na-loko (April) and an unsexed specimen at Mt. Gyi-na-loko in October or November.

Spelaeornis rocki Riley

Proc. Biol. Soc. Wash., **42**, 1929, p. 214 (Mountains of Ho-fu-ping, Mekong Valley, Yunnan).

As Riley remarks, it is a strange thing to find a distinct species so close to the type locality of *Spelaeornis souliei* Oustalet. I have compared the specimens at hand carefully with the figure of the type of *souliei*.[1] As Riley found in comparing the type of *rocki*, so I find that the birds that Rock has sent are lighter above and the black apical spots are more conspicuous, that the flanks are lighter and the black apical spots of that region are smaller, and that the white of the throat extends to the jugulum. Of these characters I consider that the last only is of any value. Due to the fact that the spring birds are in worn and faded plumage (the ones at hand are distinctly so) and that all the birds in the Paris Museum were mounted and exposed to the light until very recent times and that consequently most of them are "foxed" badly, it can be readily understood that the colors of the new skins might very easily be quite different from the type and the differences be just such as are described above. However, the white of the throat does extend to the jugulum and for that reason I recognize *rocki*.

A female and an unsexed specimen come from Tao-mung-chung and a female and an immature bird from Chou-yu-gko (April).

Nannus troglodytes talifuensis (Sharpe)

Anorthura talifuensis Sharpe, Bull. B. O. C., **13**, 1902, p. 11 (Gyi-dzin-shan).

Two males, a female and an immature specimen were taken at Tao-mung-chung (April or May), two pairs at Mt. Gyi-na-loko (October or November), a male and two females at Mt. Satseto (December) and two males, a female and one unsexed specimen from the Likiang Snow Range (February).

In comparison with a series of birds taken in Sechuan in winter these birds are appreciably darker. There is, however, a good deal of individual variation.

A curious fact came to my notice in examining the series in the Museum of Comparative Zoölogy. It is that there are two specimens from Choni (Nos. 135,791, 135,792) which are indistinguishable from the Yunnan bird. They are quite mature and were taken in

[1] Novit. Zoöl., **17**, 1910, pl. 7, fig. 1.

winter. From another area they might be thought to belong to an intermediate form, but Choni should harbor an intermediate between the light *Nannus t. szetschuanensis* Hartert and the even lighter *Nannus t. idius* (Richmond) rather than a very dark form.

Prunella immaculata (Hodgson)

Accentor immaculata Hodgson, Proc. Zoöl. Soc. London, **13**, 1845, p. 34 (Nepal).

A single male was taken on Mt. Gyi-na-loko in October or November and five more at different levels of the west slopes of Mt. Satseto in December, January and February.

Prunella strophiata multistriata (David)

Accentor multistriatus David, Ann. Mag. Nat. Hist., **7**, 1871, p. 256 (Moupin).

Three males, three females and two unsexed specimens were taken on the east slopes of the Likiang Snow Range in November and December; two males, three females on the west slopes of Mt. Satseto in January and February; a male and an unsexed specimen at Tao-mung-chung in April or May; a single female at Chou-yu-gko in May and three unsexed specimens at Su-wa-tong, Tibet, in July.

Prunella collaris ripponi Hartert

Vög. Pal. Faun., **1**, 1910, p. 766 (Gyi-dzin-shan).

Of a series of six birds, five come from the Likiang Snow Range, a male was taken at Mt. Gyi-na-loko in October or November, a female in February at Mt. Satseto and a male and two females in March. A single male was taken at Su-wa-tong, Tibet, in July.

Prunella collaris berezowskii (Serebrowski)

Laiscopus collaris berezowskii Serebrowski, C. R. Acad. Sci. Leningrad, 1927, A, p. 325 (Lun-ngan-fu, Sechuan).

Serebrowski described this bird as being lighter than *Prunella c. nipalensis* (Blyth) and darker than *Prunella c. tibetanus* Bianchi. I add that it is like *Prunella c. ripponi* Hartert but larger. The wing measures 103 mm. in this specimen. It is also more dusky on the flanks.

Rock has sent a single male from Mt. Satseto (March).

Enicurus maculatus guttatus Gould

Proc. Zoöl. Soc. London, 1865, p. 664 (Sikkim).

A single immature specimen of this bird was taken at Champutong in July.

Enicurus leschenaulti sinensis Gould

Proc. Zoöl. Soc. London, 1866, p. 665 (Shanghai).

Two males were taken at Chou-yu-gko (April) and an immature specimen sexed as a female from the banks of the Wei-hsi River at 9,000 ft. in June.

Calliope tschebaiewi Przewalski

Mongol I. Stran. Tang., **2**, 1876, p. 44.

A single male comes from Tao-mung-chung (April or May).

Larvivora brunnea Hodgson

Journ. Asiat. Soc. Bengal, **6**, 1837, p. 102 (Nepal).

A single male was taken at Tao-mung-chung in April or May.

Phoenicurus schisticeps (Gray)

Ruticilla schisticeps Gray, Cat. Mamm. Birds Nepal Coll. Hodgson, 1846, p. 69 (Nepal).

In a series of twenty-two birds the wings measure: 81–86 for the males and 78–80 for the females. Five males were taken at Mt. Gyi-na-loko (October or November), two males and a single female at Shwe-menkan (January), two males and seven females at Mt. Satseto at the end of January and the beginning of February; seven females at the same place in March.

Phoenicurus frontalis frontalis Vigors

Proc. Comm. Zoöl. Soc. London, 1832, p. 172 (Himalaya).

Three males and four females were taken at Mt. Gyi-na-loko in October, November, a pair on Mt. Satseto in December and a single male in March; two males and a single female come from Tao-mung-chung (April or May).

The autumn and winter males of this series have the feathers of the back tipped with reddish brown and the females are dark brown on the back rather than gray as are the spring and summer specimens.

Phoenicurus aurorea aurorea (Pallas)

Motacilla aurorea Pallas, Reis. Russ. Reichs., **3**, 1776, p. 695 (Selenka, Lake Baikal).

Two males were taken at Tao-mung-chung (April or May) and a female at Chou-yu-gko (April). They are no darker than specimens taken by Rock on the Kansu border of Sechuan in 1928. I have, therefore, followed Stuart Baker in considering the Yunnan bird to be identical with the Indian and northern Chinese birds.

Phoenicurus hodgsoni (Moore)

Ruticilla hodgsoni Horsfall & Moore, Cat. Birds Mus. E. Ind. Co., 1854, p. 308 (Nepal).

A male comes from Shwe-men-kan (January), a female from Mt. Satseto (February) and a female from Tao-mung-chung (April or May).

Rhyacornis fuliginosa fuliginosa (Vigors)

Phoenicura fuliginosa Vigors, Proc. Zoöl. Soc. London, 1831, p. 35 (No locality).

Six males and four females come from Tao-mung-chung, seven males and two females from Chou-yu-gko (April), two males from the mountains west of Wei-hsi (June) and one immature male from Su-wa-tong (July).

Chaimarrhornis leucocephala (Vigors)

Phoenicura leucocephala Vigors, Proc. Zoöl. Soc. London, 1831, p. 35 (Himalayas).

Rock has sent a male from Su-wa-tang, Tibet, (July) and two females from Tao-mung-chung (April or May). The male was molting.

Tarsiger chrysaeus vetellinus Stresemann

Journ. f. Orn., **71**, 1923, p. 365 (Washan).

A series of fifteen mature specimens proves this race to be lighter than the Indian bird which is noticeably more orange.

Six males and nine females come from Su-wa-tong, Tibet, (July), as do eleven immature specimens. A single female was taken at Mt. Gyi-na-loko (October or November). An immature bird taken at the mountains of Tung-la in August seems to have the flanks yellow; birds taken a month earlier do not.

Muscisylvia leucura Hodgson

Proc. Zoöl. Soc. London, 1845, p. 27 (Nepal).

A single immature specimen (unsexed) was taken at Champutong in July.

Rhodophila ferrea haringtoni (Hartert)

Oreicicla ferrca haringtoni Hartert, Vög. Pal. Faun., **1**, p. 711 (Lien-kiang bei Futschau, China).

Rock has sent a series of thirteen birds; a single male from Tao-mung-chung (April or May), seven males, a female and two immature specimens from the mountains west of Wei-hsi (June) and a male from the mountains of Tse-chung (August or September).

Ianthia indica yunnanensis (Rothschild)

Tarsiger indicus yunnanensis Rothschild, Bull. B. O. C., **43**, 1922, p. 10 (Likiang Range).

A male and three females were taken at Tao-mung-chung (April or May) and a single female at Chou-yu-gko in April.

Ianthia rufilata practica Bangs and Phillips

Bull. Mus. Comp. Zoöl., **58**, 1914, p. 292 (Loukouchai).

Of a series of twenty-one of these birds, a male and two females were taken at Tao-mung-chung (April or May), a single female at Chou-yu-gko (April), and three males and ten females from Mt. Gyi-na-loko (October or November). Three immature specimens were taken at the mountains of Tung-la and at Su-wa-tong (July).

Riley has remarked that males exhibit two color phases, one cyanite blue above and the other marine blue. This I find to be true of my specimens, except that the blue is rather closer to alizarine than to navy. This difference in coloration is shown by two specimens that were taken at the same locality at the same time.

Saxicola torquata przewalskii (Pleske)

Pratincola maura var. *przewalskii* Pleske, Wis. Res. Przewalski's Reis., Vög. **1**, 1889, p. 46 (Kansu).

Two males, a female and an immature specimen are from Tao-mung-chung (April or May), a single male from the Likiang Snow Range (March).

These birds are noticeably larger and darker than *Saxicola t. indica* (Blyth) and *Saxicola t. stejnegeri* (Parrot).

Myiophoneus coeruleus (Scopoli)

Gracula coerulea Scop., Del. Flor. Faun. Insubr., **2**, 1786, p. 88 (China).

A female comes from the mountains of Tung-la (To-la) (August) and a male from Mt. Gyi-na-loko (October or November).

Monticola rufiventris (Jardine and Selby)

Petrocincla rufiventris J. &. S., Illust. Orn., **3**, pl. 129, 1828 (Himalayas).
Turdus erythrogaster Vigors, Proc. Zoöl. Soc. London, 1831, p. 171.
Monticola erythrogastra Baker, Faun. Brit. Ind., **2**, p. 170.
Monticola erythrogaster La Touche, Handb. Birds East. China, 1925, p. 123.
Monticola rufiventer sinensis Meinertzhagen, Bull. B. O. C., **47**, 1927, p. 148.

An unsexed immature specimen and an immature female were taken in the mountains of Tung-la (To-la), above Ho-fu-ping, on the Mekong side of the Yangtze-Mekong Divide, 12,000 to 14,000 ft. in August.

These two specimens differ somewhat from the description in La Touche's "Handbook of the Birds of Eastern China," which is the most complete and satisfactory, and I therefore describe them here.

Feathers of the head and upper back are black with a large white spot; on the lower rump they are barred olive and black, and the upper tail coverts are barred bay and black. The ear coverts are black, some of the feathers having white shafts. Feathers of the throat have the white spot very large. On the breast the feathers have large yellow spots, and on the flanks these spots are brownish yellow.

A nestling from the La Touche collection, taken in Kuatun, N. W. Fukien on May 22, agrees very closely with the present series. The spots on the feathers are more uniformly yellow, however, and this character conforms more nearly to the general impression of yellowness that descriptions give. I believe that the difference is probably due to age, partly of the wild specimen when it was shot and partly to the "foxing" or fading toward brownish that skins undergo in museums.

Female specimens of *rufiventris* from China in this museum are not "darker or more slate colored above" nor have they "the ground

color of the feathers of the under parts more black brown, giving a darker appearance,"[1] than specimens from Sikkim. I cannot find that the Chinese bird differs in any way from the Indian.

Turdus rubrocanus gouldi (Verreaux)

Merula gouldi Verr., Nouv. Arch. Mus. Hist. Nat. Paris, Bull., **6**, 1871, p. 34 (western Sechuan).

This series is made up of three males from Tao-mung-chung, taken in April or May, two males and two females from Chou-yu-gko, taken in April, and a pair, a single female and an unsexed specimen from the mountains of Tung-la (To-la), taken in August, and four males from Mt. Satseto (October or November).

This bird appears to be confined to high altitudes. I cannot find that it has ever been taken below 10,000 ft.

The series is remarkably uniform. There are none of the individual differences reported to occur. The females are lighter than the males.

Turdus naumanni eunomus Temminck

Pl. Col., 1830, p. 514 (Japan).

Of nine specimens in the series there are four males, one from the banks of the Yangtze at Shi-ku, two from the eastern slopes of Mt. Satseto (December), and a fourth from the eastern slopes of the Likiang Snow Range (February). Four females come from Tao-mung-chung (April or May) and a single female from Shwe-men-kan (January).

Dr. B. Stegmann of the Academy of Sciences, Leningrad, writes that the breeding area of *Turdus n. eunomus* Temm. lies to the northward of *Turdus n. naumanni* Temm. The breeding area of *eunomus* is Siberia, from the southern edge of the tundra and the lower course of the Jenissei, south to the northern Baikal Range and east to Bering Sea. *Turdus n. naumanni* Temm. breeds from the middle reaches of the Jenissei River over the northern Baikal Range and south Jakutia to the Stanoi Range. The breeding areas of these two birds do not overlap.

Dr. Stegmann believes that the differences in coloration are great enough so that these birds might be considered as distinct species. However, he also says that their habits and voice are very similar and that they may with reason be thought to be subspecies.

Since their breeding ranges do not overlap, their habits are similar and they are so similar in appearance, I prefer to list them as subspecies.

[1] vide Meinertzhagen Bull. B. O. C., **47**, 1927, p. 148.

Turdus naumanni naumanni Temminck

Man. d'Orn., **1,** 1820, p. 170 (Eastern Europe).

A male comes from Tao-mung-chung and a female from the Likiang Snow Range, east slopes of Mt. Satseto. The former was taken in April or May and the latter in March. Two unsexed specimens were shot at the foot of the Likiang Snow Range in March.

The male is darker than the female, having the feathers of the upper breast marked with a chestnut subterminal bar while the female has the bars amber.

Turdus obscurus Gmelin

Syst., Nat., **1,** 1789, p. 816 (Lake Baikal).

Three females were taken at Mt. Gyi-na-loko in October or November.

Turdus mupinensis conquistus Bangs

Bull. Am. Mus. Nat. Hist., **46**, 1921, p. 591 (Likiang Range).

Two males were taken at Tao-mung-chung in April or May.

Turdus ruficollis ruficollis Pallas

Reise Russ. Reichs, **3,** 1776, p. 694 ("In Summis ingis Dauuriae").

Only one specimen, a male, was collected at Tao-mung-chung in April or May.

Turdus mollissimus mollissimus Blyth

Journ. Asiat. Soc. Bengal, **11**, 1842, p. 188 (Darjeeling).

Rock has sent two males from the east slopes of Mt. Gyi-na-loko taken in October or November. These birds have the terminal black bars of the underparts not crescentic like the typical bird but rather drawn straight across the feather. There are also fewer of these black bars so that the underparts appear lighter and the belly pure white. The color of the back is a light greenish brown, not the dark olive brown of the Indian bird.

Of a series of ten skins kindly loaned to me by the United States National Museum, nine are identical with the Indian bird, the tenth, however, is much like the birds that Rock has just sent. It was shot at Mt. Omei, Sechuan in December.

Breeding specimens of *mollissimus* have been taken in northwest Yunnan and southeast Sechuan. It does not seem very probable that there is a geographical representative isolated in this region, mountainous and given to curious faunal variations as it is.

TURDUS DAUMA SOCIUS (Thayer and Bangs)

Oreocincla dauma socia Thayer & Bangs, Mem. Mus. Comp. Zoöl., **11**, No. 4, Aves, 1912, p. 174 (Tatsienlu).

A single male comes from Tao-mung-chung (April or May).

POMATORHINUS RUFICOLLIS SIMILIS Rothschild

Novit. Zoöl., **33**, 1926, p. 261 (Hills near Tengyueh).

A single female taken in the mountains of Tung-la (To-la) in August has the outer webs of the primaries brown instead of grayish green and a browner appearance than the other specimens in the series. Only the base of the upper mandible is black, whereas two-thirds of the upper mandible is black in the other birds of this series. The wing measures 81 mm., the tail 100 mm., the exposed culmen 18 mm.

There are eleven specimens in the series, three males and two females from Tao-mung-chung (April or May), two males and three unsexed specimens from Mt. Satseto (December).

POMATORHINUS MACCLELLANDI DEDEKENSI Oustalet

Ann. Sci. Nat. Zoöl., ser. 7, **12**, 1892, pp. 276, 304 (Southern Shensi).

A male and two unsexed specimens have been sent from Tao-mung-chung (April or May), a pair from Chou-yu-gko (April) and three pairs from the western slopes of Mt. Satseto in December, January or February.

Pomatorhinus m. gravivox David, the eastern form, seems to be browner and less green, season for season, than *Pomatorhinus m. dedekensi* Oust. from western Sechuan and northern Yunnan. It is also smaller, the wing measuring 90–95 mm. as against 98 and over. *Pomatorhinus m. odicus* Bangs and Phillips, which is the southern Yunnan form, is smaller still, but resembles *dedekensi* very closely in other respects.

I have examined six specimens of *gravivox* from Hupeh taken in May, June, October, November, January and February, two specimens of *dedekensi* from the Likiang range (June) and two from south-

western Sechuan (May and January), as well as a very long series of *odicus* from the vicinity of Mongtz. There is a great deal of individual variation in the size of the bill as well as the colors in this group. The color of the back seems to have "foxed" or grown browner in the older specimens.

Garrulax albogularis albogularis (Gould)

Ianthocincla albogularis Gould, Proc. Zoöl. Soc. London, 1835, p. 187 (Nepal).

Six males and eight females have been sent from Tao-mung-chung and Chou-yu-gko in April and May. These birds are slightly darker than specimens of *albogularis* from northern India in the Museum of Comparative Zoölogy.

Garrulax subunicolor griseata (Rothschild)

Ianthocincla subunicolor griseata Roths., Novit. Zoöl., **28**, 1921, p. 33 (Schweli-Salween divide).

To Rothschild's description I add that the specimens at hand have the feathers of the cheeks and ear coverts with whitish shafts, contrasting with the head and neck.

Two pairs, a male and a female have the primaries molting. They were taken at Su-wa-tong, Tibet, in July.

Garrulax affinis oustaleti (Hartert)

Ianthocincla affinis oustaleti Hart., Vög. Pal. Faun., **1**, 1909, p. 633 (Tsekou).

Two males and a female were taken at Tao-mung-chung in April or May and a pair at Chou-yu-gko in April, eight males on the Likiang Snow Range in October, November and December and two unsexed specimens from the east slopes of the same range in February, seven males, six females and six unsexed immature specimens from Su-wa-tong, Tibet, (July) and a single male from Su-wa-tong in January. A nestling was taken at the mountains of Tung-la (To-la) in August.

The nestling agrees perfectly with the description that Rothschild gives.[1] "Plumage differs from the adults by the brown, not black, crown, the absence of the gray patch at the side of the neck, and the uniform brown of upper and underside."

[1] Novit. Zoöl., **33**, 1926, p. 264.

Garrulax elliotii elliotii (Verreaux)

Trochalopteron elliotii Verreaux, Nouv. Arch. Mus. Paris, Bull., **6**, 1870, p. 36 (Mountains of Chinese Tibet).

Two males, five females and two unsexed specimens were taken at Tao-mung-chung in April or May; two males and one female at Chou-yu-gko in April; a male and two unsexed specimens at the mountains of Tung-la (To-la) in August; a single female at Champutong (Chamutang) in July; an unsexed specimen on the eastern slopes of Mt. Satseto in March, and five males, three females and one unsexed specimen at Mt. Gyi-na-loko in October or November. This series of twenty-two specimens was taken at all seasons of the year in the Likiang District.

After a careful comparison of these birds and a good series in the Museum of Comparative Zoölogy, it is apparent that the silvery white tips to the feathers, particularly of the throat, are lost by a process of wearing in the spring and summer. For this reason there is little doubt that *Garrulax bonvaloti*, which Oustalet described "with many reservations" from Chatou, Tibet, as being without the little white marks on the head, cheeks, neck and breast, is a synonym of *Garrulax e. elliotii* (Verr.). Riley [1] and Berlioz [2] are agreed about this.

Winter birds are likewise somewhat darker and grayer than summer birds. Although I have no specimens identified as *Garrulax e. yunnanense* Rippon, described from the Yangtze River, Likiang Range, Yunnan, as darker and altogether grayer than *elliotii*, I am inclined to believe that Riley is right that this character is due to seasonal variation and that *yunnanense* cannot be maintained as a valid race.

Furthermore these birds conform very closely to the description of *Garrulax e. prjevalski* which Menzbier described [3] from Kansu. As Bangs and Peters have said, [4] the gray instead of greenish tail feathers seems to be the only distinguishable character by which *prjevalski* can be separated from *elliotii*. The present series shows gradation from gray to green.

Garrulax cineracea styani Oustalet

Bull. Mus. Paris, **6**, 1898, p. 226 (Ta-tsien-lou).

Two specimens of this bird, both males, were taken in the mountains of Tse-chung in August or September, 1931.

[1] Proc. U. S. Nat. Mus., **80**, 1931, p. 37.
[2] Rev. Hist. Nat. 1, 2, 3, 1930.
[3] Ibis, 1887, p. 300.
[4] Bull. Mus. Comp. Zoöl., **68**, 1928, p. 341.

These two specimens have the cheeks white, the superciliary line olive gray and the ear coverts a faded color approaching buffy yellow. Some of the feathers of this region are white at the base and buffy yellow only at the tip. I place them with *styani* after Rothschild,[1] rather than La Touche,[2] because of the plate of *cinereiceps* with Styan's description,[3] which shows the chestnut ear coverts and superciliary line quite plainly.

There are, however, in the collections of the Museum of Comparative Zoölogy, two specimens with the olive gray superciliary line and the faded buffy yellow ear coverts, which obviously are *styani*, but which were taken at Szemao, south Yunnan, on February 28, far south of the range assigned to them by Rothschild. Bangs in an unpublished paper which he has kindly allowed me to see, has suggested that these birds migrated south to Szemao in winter.

Garrulax bieti (Oustalet)

Ianthocincla bieti Oust., Bull. Mus. Paris, **3**, 1897, p. 163 (Tsekou, upper Mekong, Yunnan).

Rock has sent a male and three females from Tao-mung-chung, taken in April or May. There is also an unsexed specimen from Chou-yu-gko, above Tao-mung-chung.

There is a great deal of individual variation in the color of the head and the extent of the subterminal black bars of the feathers of the side of the neck and the flanks. I am inclined to agree with Riley[4] that these are age characters.

A specimen sexed as a female, with the fluffy plumage and relatively pointed remiges of immaturity, has the feathers of the head medal bronze and the subterminal black bars of the sides of the neck and the flanks are lacking.

Garrulax lanceolatus lanceolatus (Verreaux)

Pterorhinus lanceolatus Verr., Nouv. Arch. Mus. Paris, Bull., **6**, 1871, p. 36 (Mountains of Chinese Tibet).

Four males, a female and an unsexed specimen were shot at Tao-mung-chung (April or May).

Even in this small series the character of the color of the moustachial line does not run true. In two specimens it is almost auburn

[1] Rothschild, Novit. Zoöl., **33**, 1926, p. 264.
[2] Birds of Eastern China, **1**, p. 60.
[3] Ibis, 1887, p. 167, pl. 6.
[4] Proc. U. S. Nat. Mus., **80**, 1931, p. 34.

with black tips to the feathers, while in the others it ranges from darker brown to black.

I consider *Garrulax bonvaloti* Oust. and *Garrulax yunnanensis* Rippon to be synonyms of *lanceolatus*.

Garrulax ocellatus similis (Rothschild)

Ianthocincla ocellata similis Roths., Novit. Zoöl., **28**, 1921, p. 34 (Shweli-Salween Divide).

This bird is apparently an intermediate form between *Garrulax ocellatus ocellatus* (Vig.) and *Garrulax ocellatus artemisiae* (David and Oustalet). It resembles *ocellatus* rather than *artemisiae* in that the color of the ear coverts is rather brown than black or gray; this brown is, however, much lighter than the single specimen of *ocellatus* in the Museum of Comparative Zoölogy. The superciliary line is as light as in *artemisiae*.

The character which Lord Rothschild mentions for *artemisiae* in his description of *similis* [1] "... feathers of the breast and foreneck having large black markings," does not seem to be borne out in the small series in the Museum of Comparative Zoölogy. There is, however, a female of *artemesiae* which has the color of the ear coverts brownish gray and this would lead one to believe that there must be a more distinctly intermediary form which is now furnished by the specimen in question.

Apparently forms like the present one have never been taken. Rock collected this one from Chou-yu-gko in April.

Garrulax maximus maximus (Verreaux)

Pterorhinus maximus Verreaux, Nouv. Arch. Mus. Paris, Bull., **6**, 1870, p. 36, pl. 3 (No locality).

Four males and two females come from Mt. Gyi-na-loko (October or November) and a female from Shwe-men-kan (January) and two males from the Likiang Mountains (west slopes) taken in February, 1932.

Garrulax maximus khamensis (Serebrowski)

Ianthocincla maxima khamensis Serebrowski, C. R. Ac. Sci. de l'U. R. S. S., Leningrad, 1927, p. 325 (Kham country, E. Tibet).

Unfortunately Rock has sent only a single specimen of this bird from the mountains of Tung-la (To-la) (August). It is apparently an

[1] Novit. Zoöl., **28**, 1921, p. 34.

immature bird, but in comparison with other immature birds from Sechuan it is noticeably smaller. This is the only character that holds. The paler underside and the narrower dark bars of the chest seem to be age characters as Berlioz has remarked.[1] Its small size has led me to place it with the Kham bird but not without a good deal of misgiving.

Garrulax sannio sannio Swinhoe

Garrulax sannio Swinh., Ibis, 1867, p. 403 (Amoy, Fukien).

It is apparent from the long series in the Museum of Comparative Zoölogy, taken at all seasons of the year from Fukien to southern and western Yunnan, that this bird is darker in winter than in summer and that this change is due largely to the wearing of the feathers. Birds killed in the province of Hupeh in November and December are as dark as those taken at Mongtz, southern Yunnan, at the same season. Everywhere they all become lighter as the season goes on. There is a molting bird shot at Mongtz in June in the collections of this museum.

La Touche[2] says "the birds at Mongtz laid in April, and the young were about the first week in May." There is no molting bird of September or October in the collection. The plumage of the November birds is quite fresh, however. The literature on the birds of China is sadly lacking in information on the subject of migrations.

It seems to me probable that *Garrulax albospecularis* (Godwin-Austin) is *Garrulus sannio sannio* Swinh. in worn plumage and for this reason I follow Rothschild and Riley in relegating this name to synonomy.

Garrulax poecilorhyncha ricinus (Riley)

Dryonastes berthemyi ricinus Riley, Proc. Biol. Soc. Wash., **43**, 1930, p. 80 (Ndamucho, Yunnan).

In this series are two males from Chou-yu-gko (April or May).

This series in comparison with four specimens from the La Touche collection which were taken from the type locality, Kuatun, Fukien, in April and May are more olivaceous and less rufous on the head and back and the cinnamon buff of the breast is lighter. The forehead is, however, not more strongly and extensively tinged with tawny.

[1] Rev. d'Hist. Nat., no. 1, 1930, p. 14.
[2] Birds of Eastern China, p. 57.

I add to Riley's description that the terminal white bands of the outer rectrices are slightly broader and the webs of the outer rectrices are more dusky rather than brownish.

Since the Yunnan bird has the same color pattern as *poecilorhynchus* of Formosa, only differing from it in the lighter color, I prefer to consider the group as a "formenkreis" and I concur with LaTouche[1] and Stresemann [2] in doing so.

Lioparus chrysotis forresti (Rothschild)

Fulvetta chrysotis forresti Roths., Bull. B. O. C., **46**, 1926, p. 64 (Shweli-Salween Divide).

There can be no doubt that these birds are *forresti*. In comparison with birds collected by Weigold at Kwantsien, of which Rothschild speaks in the original description, and of which I have two specimens at hand, they are much deeper orange below, the primaries are edged with orange and the throat is flecked with white.

Rock has sent a series of six, four males, one female and one unsexed specimen from Tao-mung-chung (April or May).

I prefer to consider *swinhoei* and *forresti* as well as *chrysotis* as geographical representatives of the same group. Because of the very striking difference in color, the shorter hind claw and the smaller bill, I have followed Stuart Baker in retaining the genus Lioparus rather than lump these birds with the genus Fulvetta.

Fulvetta ruficapilla sordidior (Rippon)

Proparus sordidior Rippon, Bull. B. O. C., **13**, 1903, p. 60 (W. Yunnan).

Five males and four females were taken at Mt. Satseto in December.

Fulvetta striaticollis striaticollis (Verreaux)

Siva striaticollis J. Verreaux, Nouv. Arch. Mus. Paris, Bull., **6**, 1870, p. 38 (Moupin).

Three specimens, two males and a female come from Shwe-men-kan (January).

These specimens are somewhat lighter below than the specimens from Sechuan in the collections of the Museum of Comparative Zoölogy. There are intermediates, however, and since the birds that Rock has

[1] Birds of East China, 1925, p. 57.
[2] Abh. u. Ber. d. Mus. f. Tierk. u. Volkerk. zu Dresden, **16**, No. 2, 1923, p. 23.

sent are winter specimens and those in the Museum of Comparative Zoölogy were taken in summer, I am inclined to believe that lightness is a seasonal character.

Fulvetta cinereiceps yunnanensis (Rothschild)

Proparus striaticollis yunnanensis Roths., Bull. B. O. C., **43**, 1922, p. 11 (Mekong-Salween Div.).
Fulvetta insperata Riley, Proc. Biol. Soc. Wash., **43**, 1930, p. 123.

Because there have been several errors made in the identification of this bird in the past, I have had a good deal of difficulty in diagnosing it. In the first place Rothschild erred in placing it with the *striaticollis* "formenkreis." It undoubtedly belongs with the *cinereiceps* group. Secondly, this mistake confused Riley when he found this bird in the collection sent to the United States National Museum by Rock. I have the type of his *Fulvetta insperata* at hand and it is identically the same as my birds, which Kinnear has seen and identified as *Fulvetta s. yunnanensis* Roths., after comparing them with specimens in the British Museum.

The Chinese forms of the genus may be identified by the following key:

- A. Flanks and belly alike
  - a. Ear coverts black .... *vinipectus bieti*
  - b. Ear coverts striped .... *striaticollis*
- B. Flanks and belly different
  - a. Distinct white ring around the eye .... *ruficapilla*
  - b. No white ring around the eye
    - b′. Three innermost primaries edged with brown *cinereiceps*
    - b″. Three innermost primaries all black .... *fucata*

The cinereiceps group may be diagnosed as follows:

- A. Head gray; no black stripe
  - a. Back distinctly reddish brown .... *cinereiceps*
  - b. Back lightly washed with red .... *fessa*
- B. Head brown; indistinct black lines .... *guttaticollis*
- C. Head sooty brown; distinct black lines .... *yunnanensis* *tonkinensis*

There is no character that will serve to distinguish *yunnanensis* and *Fulvetta c. tonkinenesis* Delacour, which may conveniently be put into a key, though when specimens of each are seen together the differ-

ences are marked. *Fulvetta c. tonkinensis* is much darker. The brown of the flanks and rump is deeper and redder and the crown is a darker gray.

I have never seen a specimen of *Fulvetta ruficapilla manipurensis* Grant and I am not sure that it belongs to the *ruficapilla* group. Kinnear has written to me as follows: "... *Fulvetta r. manipurensis* ... has the head intermediate in color between *yunnanensis* and *sordidior*, the back tinged with the color of the head and the rump richer — an ochraceous brown — below, the thighs and abdomen are similar to the rump and the breast is also tinged with the same color as the back."

As far as is known the ranges of the Chinese forms of Fulvetta may be outlined as follows:

Fulvetta vinipectus bieti Oust.; from the Mekong Valley in southeast Tibet, east to Tatsienlu where it breeds in late May (Weigold), south to Tseku and the Shweli-Salween Divide.

Fulvetta s. striaticollis (Verr.); Upper Tebbuland, Kansu, south to Tatsienlu, where it breeds in July (Weigold).

Fulvetta r. ruficapilla (Verr.); Tsin-ling mountains, northern Sechuan, south to Kwan and Tankwan, southern Sechuan.

Fulvetta ruficapilla sordidior Roths.; mountains of Ho-fu-ping, Yangtze-Mekong Divide, east to the Likiang Range and south to the Tengueh District.

Fulvetta c. cinereiceps (Verr.); Western Sechuan, where it has been taken in spring, summer and early autumn, east to Hsien-shansien, Hupeh, where Zappey took it in December, and Ichang, Hupeh, from which locality an autumn bird was described by Styan. It is recorded as "resident" in Hupeh by Gee, Moffet and Wilder.[1]

Fulvetta c. fessa Bangs and Peters; Ha Tebbuland and Choni, Kansu.

Fulvetta c. guttaticollis La Touche; Fukien (resident), Kwantung (winter).

Fulvetta c. yunnanensis Roths.; Mekong Valley, Mekong Salween Divide; Yangtze-Mekong Divide.

Fulvetta fucata Styan; Hupeh; Ho-chaping (in the mountains north of the Yangtze) (April) and Ichang (December).

It is not yet possible to say whether *Fulvetta c. cinereiceps* and *Fulvetta fucata* have overlapping breeding areas, nor do we know whether *Fulvetta c. yunnanensis* Roths. and *Fulvetta r. sordidior* Roths. nest in the same locality somewhere in their ranges.

Rock has sent a pair and a single unsexed specimen from Tao-mung-chung (April or May) and a male from Chou-yu-gko, taken in April.

[1] Pekin Soc. Nat. Hist., Bull., 1, 1926, p. 177.

Fulvetta vinipectus bieti (Oustalet)

Alcippe bieti Oust., Ann. Sci. Nat., **12**, 1892, p. 283, pl. 9, fig. 2 (Ta-tsien-lou).

This good series consists of two males, two females and two unsexed specimens from Tao-mung-chung (April and May); four males from Chou-yu-gko (April), two females and two unsexed specimens from the Mountains of Tung-la (August), a male from the Likiang Snow Range; a male and an unsexed specimen from Su-wa-tong, Tibet, in July. In December Rock got four pairs, a female and an unsexed specimen on Mt. Satseto, and in February a male and two females.

Moupinia poecilotis sordidior Rothschild

Novit. Zoöl., **28**, 1921, p. 36 (Likiang Range).

Rock has sent four males, one from the Likiang Snow Range (March), two from the Shwe-men-kan (January) and one from Likiang Range (February).

Schoeniparus dubius genestieri (Oustalet)

Alcippe genestieri Oust., Bull. Mus. Hist. Nat. Paris, **3**, 1897, p. 210 (Tsekou).

A male and one unsexed specimen were taken at Tao-mung-chung (April or May) and another male was taken in the mountains west of Wei-hsi in June. Four males and seven females come from Mt. Satseto. One male and five females were taken in February, the others in December.

Pseudominla castaneiceps castaneiceps (Hodgson)

Minla castaneiceps Hodgs., Ind. Rev., 1838, p. 38 (Nepal).

One unsexed specimen comes from Champutong (Chamutang) (July).

This appears to be the extreme northern and eastern extent of the range. Stuart Baker [1] gives the range east to the Shan States and the hills of central and east Burma. Rothschild [2] reports that Forrest was the only collector to send this bird from Yunnan and he only sent eight from the Tengueh District and the Schweli-Salween Divide. It is curious that La Touche has not recorded the bird from southern Yunnan, since Delacour [3] found it quite common at Chapa, near Lao-

[1] Faun. Brit. Ind., p. 289.
[2] Novit. Zoöl., **23**, 1926, p. 270.
[3] Ois. de l'Indo-Chine, p. 308.

Kay, in northern Tonkin, although he has not found it elsewhere, nor did Van Tyne [1] take it in upper Laos. In the present state of knowledge, therefore, its range is discontinuous and it is isolated at Chapa, 250 miles from the border of the Shan States.

Heteroxenicus cruralis formaster Thayer and Bangs

Mem. Mus. Comp. Zoöl., **40**, 1912, p. 169 (Washan, W. Sechuan).

Anyone attempting to identify birds of this group will find that a good deal of confusion has existed. There have been three forms described:

1. *Heteroxenicus c. cruralis* Blyth, ranging from Simla eastward, both north and south of the Brahmaputra, through Assam, the Chin and Cachin Hills of northern Burma to S. W. Yunnan (two specimens of this form from Mongtz are in the Museum of Comparative Zoölogy).
2. *Heteroxenicus c. laurentii* La Touche, which is only known from the type, which comes from Mongtz and is in the Museum of Comparative Zoölogy. Since this bird was shot in October it would seem probable that it was on migration in southern Yunnan. It is indistinguishable from
3. *Heteroxenicus c. formaster* Thayer and Bangs, the type of which comes from Washan in western Sechuan, and is recorded by Riley [2] from the Likiang Range. The wing of the type specimen measures 73 mm. as does the wing of the type of *Heteroxenicus c. laurentii* La Touche.

Rock has sent a male from Tao-mung-chung, taken in April or May and a pair from Chou-yu-gko, taken in April. The males are at once recognizable as the Chinese bird because of the stout bill and I have placed them with *formaster* in the belief that *laurentii* is a synonym of that form, La Touche having somehow, unaccountably, overlooked it. The female which Rock has sent resembles the Indian bird a little more in color than it does the Chinese, but because this shade of olivaceous brown is variable and subject to fading and the size of the bird (wing 71 as against 65 for females of the Indian bird in the Museum of Comparative Zoölogy), I have placed it with *formaster*.

There is one more difficulty. Rothschild has recorded [3] *Brachypteryx* (*Heteroxenicus*) *c. cruralis* Blyth from the Likiang Range. I think it probable that since Rothschild had never seen specimens of the large billed form from China, the specimens that he has recorded as *cruralis* are really *formaster*.

[1] Field Mus. Nat. Hist. Zoöl. ser., **18**, 1931.
[2] Proc. U. S. Nat. Mus., **80**, 1931, p. 51.
[3] Novit. Zoöl., **33**, 1926, p. 271.

Leioptila desgodinsi desgodinsi (David and Oustalet)

Sibia desgodinsi Dav. & Oust., Bull. Soc. Philom. Paris, **1**, 1877, p. 139 (Yer-ka-lo).

Two pairs come from the mountains of Tung-la (To-la) (July), a male from Champutong (July), a male, a female and an unsexed specimen from Tao-mung-chung (April or May), two males from Chou-yu-gko (April), a male and two females from Mt. Gyi-na-loko (October or November) and two males and three females from Mt. Satseto (December and February).

Leioptila pulchella coeruleotincta Rothschild

Novit. Zoöl., **28**, 1921, p. 38 (Shweli-Salween Divide).

Two males and three females were taken at Su-wa-tong, Tibet, in July.

Stachyridopsis ruficeps bhamoensis (Harington)

Ann. Mag. Nat. Hist., ser. 8, **2**, 1908, p. 245 (Bhamo).

Three specimens, two males and a female, were taken on the mountains of Tse-chung in August or September and a pair at Champutong (Chamutang) in July.

These birds are clearly the breeding birds of the region. They are molting. They resemble very closely *Stachyridopsis r. bangsi* La Touche but they differ in having the black lines of the throat much more clearly defined and much larger. Their upper plumage is rather faded as in other summer birds in the series of the Museum of Comparative Zoölogy.

Siva strigula yunnanensis Rothschild

Novit. Zoöl., **28**, 1921, p. 40 (Likiang mountains).

This is a good series of twenty-five specimens, a male and two females from Tao-mung-chung (April or May), two pairs from the mountains of Tung-la (To-la) (August), eight males, seven females and an unsexed specimen from Mt. Satseto (December) and a single female from Shwe-men-kan (January).

The series from Tao-mung-chung and the mountains of Tung-la, taken in spring and summer are all in the gray plumage, which according to Rothschild [1] and Riley [2] is characteristic of birds at this season

[1] Novit. Zoöl., **28**, 1921, p. 40.
[2] Proc. U. S. Nat. Mus., **70**, 1926, p. 30.

of the year. Winter birds taken at Mt. Satseto and Shwe-men-kan are in the brownish plumage.

The irides of these specimens are all recorded as "bright red or crimson" while the eye of *Siva s. castaneicauda* Hume is recorded by Stuart Baker[1] as deep brown, as it is on the label of a specimen taken at Simla in the collections of the Museum of Comparative Zoölogy.

Yuhina gularis griseotincta Rothschild

Novit. Zoöl., **28**, 1921, p. 42 (Shweli-Salween Divide).

Three specimens, all males, two from the Mountains of Tung-la or To-la, taken in August, and one from Su-wa-tong, Tibet, taken in July, are distinctly darker than the specimens of *Yuhina g. yangpiensis* Sharpe from Sechuan. Although they are summer birds and in worn plumage, the crest is a deeper shade of brown, contrasting with the back; the throat and chest are washed with a more deep vinous tinge and the belly is a deeper buff. A pair from Shwe-men-kan, taken in January and three males and a female from Mt. Satseto are still darker.

The birds of this series have stouter bills than the Sechuan specimens in the collections of the Museum of Comparative Zoölogy. They measure 18–19 mm., while four specimens of *yangpiensis* measure 16–17 mm.

They compare closely with a single specimen of *Yuhina g. gularis* Hodgs., but since this bird was taken in 1872 it has probably "foxed" with time.

As Rothschild has remarked, this is a bird of high altitudes.

Yuhina diademata ampelina Rippon

Bull. B. O. C., **11**, 1900, p. 12 (Warar-Bum east of Bhamo).

Rock has sent sixteen specimens. Five males and four females were taken from Tao-mung-chung (April or May); three males and two females from Chou-yu-gko (April); a male from the Likiang Snow Range, eastern slopes of Mt. Satseto (March) and an immature male from the Mountains of Tung-la (August). Six males, four females and one unsexed specimen were taken at Mt. Satseto in October, November, December and February.

[1] Faun. Brit. Ind., 1, 1922, p. 314.

Yuhina occipitalis obscurior Rothschild

Novit. Zoöl., **28**, 1921, p. 42 (Likiang Range).

Rock has sent ten males and two females from Chou-yu-gko (April), seven pairs and six unsexed specimens from the mountains of Tung-la (To-la) (August), seven males and three females from Tao-mung-chung (April or May), one male and two females from Su-wa-tong, Tibet, (July) and one male from Mt. Satseto (December).

Yuhina nigrimentum intermedia Rothschild

Bull. B. O. C., **43**, 1922, p. 11 (Mekong Valley).

Twelve specimens are much darker below than a series of *Yuhina n. pallida* La Touche from Kuatun, Fukien. They have grayer throats. In this series there are six males, three females and three unsexed specimens all from Champutong (Chamutang), taken in July.

Erpornis xantholeuca griseiloris Stresemann

Journ. f. Orn., **71**, 1923, p. 364 (Siuhang, Kwangtung).

Having only a single specimen of the Indian bird for comparison, and that an old one, I follow Stresemann in separating the Yunnan bird, although, as he says, the character of the color of the head appears to be variable. Furthermore, I do not believe that the character of the greenness or yellowness of the back is stable, and I separate this bird with reluctance.

Rock has sent one specimen from Champutong (Chamutang), taken in July.

Myzornis pyrrhoura Hodgson

Journ. Asiat. Soc. Bengal, **12**, 1843, p. 984 (Nepal).

This bird is apparently rare as far east as Yunnan and confined to high altitudes as it is in Nepal and Sikkim.[1] Rock has never taken it before and Forrest has only sent six to Rothschild from the Schweli-Salween Divide and four from the Mekong-Salween Divide. In his report Rothschild says [2] that Oustalet reported a specimen sent to him by the Reverend Father Soulie from Tsekou in 1900.

Five males, two females and two unsexed specimens (July) from Su-wa-tong.

[1] Faun. Brit. Ind., 1, 1922, p. 344.
[2] Novit. Zoöl., 33, 1926, p. 278.

Pteruthius aerulatus ricketti O.-Grant

Bull. B. O. C., **14**, 1904, p. 92 (Kuatun, Fukien).

Two pairs were taken at Tao-mung-chung (April or May), a pair at Mt. Satseto (December) and a male at Shwe-men-kan (January).

Pteruthius xanthochloris pallidus (David)

Allotrius xanthochloris var. *pallidus* David, Nouv. Arch. Mus. Paris, Bull., **7**, 1871, p. 14 (frontiers of Kookonor).

A pair come from Tao-mung-chung (April or May), an unsexed specimen from the mountains of Tse-chung (August or September) and three pairs and a female from Mt. Satseto (December).

Suya sp.

There is an immature bird in the collection which I cannot identify surely. It is perhaps *Suya parvirostris* La Touche.

Alcippornis nipalensis yunnanensis (Harington)

Alcippe fratercula yunnanensis Harington, Bull. B. O. C., **33**, 1913, p. 63 (Gyi-dzin-shan, east of Talifu).

In comparison with two specimens of *Alcippornis n. fratercula* Rippon in the Museum of Comparative Zoölogy, I find that the heads of the series of seventeen birds in question are lighter gray, that the blackish superciliary line is less distinct and discontinuous, but here the differences cited in the original description cease. The underparts of the Yunnan bird are said to be "paler and of a more yellowish tinge." The under parts of the series that Rock has sent are more buffy on the breast and flanks but could not be spoken of as paler. The bill of the Yunnan bird is said in the original description to be smaller but the bills of the series at hand are noticeably larger and heavier.

It may be that the difference in coloration of the under parts is a seasonal one since the type of *Alcippornis n. yunnanensis* Harington was taken in April and the series at hand was taken in August and September. Unless, however, the birds at hand are freshly molted I cannot see that this would account for the more buffy tone to the color. It would seem likely that these birds molt in July or August since La Touche has taken *Alcippornis n. hueti* David breeding in Fukien in late June [1] but there is not a single molting bird in this series.

[1] Birds of East China, p. 75.

The Yunnan bird is undoubtedly different from its close relative *Alcippornis n. fratercula* Rippon, the range of which lies to the west and southwest, in being more buffy on the breast and flanks and having the top of the head more gray and less brownish, and from *Alcippornis n. schaefferi* La Touche in having the underparts (breast and flanks) much more buffy, *schaefferi* being lighter below than *fratercula*.

Rock has sent a single male from Su-wa-tong, two females and three unsexed specimens from Champutong (Chamutang) and two males, four females and five unsexed specimens from the Mountains of Tse-chung (August).

Tribura thoracica thoracica (Blyth)

Dumeticola thoracica Blyth, Journ. Asiat. Soc. Bengal, **14**, 1845, p. 584 (Nepal).

Five males, a single female and two unsexed specimens were taken at Su-wa-tong, Tibet, (July), and a single male from the mountains of Tung-la (August).

Neornis flavolivaceus intricatus (Hartert)

Horeites flavolivaceus intricatus Hartert, Vög. Pal. Faun., **1**, 1909, p. 533 (Tai-pai-shan, Shensi).

Four males and four unsexed specimens were taken at Su-wa-tong (July).

Horeites brunnifrons umbraticus Stuart Baker

Bull. B. O. C., **44**, 1924, p. 63 (Schweli-Salween Divide, Yunnan).

A single male specimen comes from the mountains of Tung-la (To-la) (August).

Phylloscopus armandii (Milne-Edwards)

Abrornis armandii Milne-Edwards, Nouv. Arch. Mus. Paris, Bull., **1**, 1865, p. 22 (N. China).

Their large size and the brownish cast to the feathers of the head and back distinguish these birds from all others of the group.

A pair and two unsexed specimens come from Tao-mung-chung (April or May).

Phylloscopus subaffinis (Grant)

Oreopneuste subaffinis Grant, Bull. B. O. C., **10**, 1900, p. 37 (Pu-an-ting, S. W. Kweichu).

This series is as dark or darker below, and lighter above than *Phylloscopus armandii* (Milne-Edwards) without the brownish cast to the feathers of the back and head. It is distinctly smaller.

Rock has sent a pair, a female and two unsexed specimens from the mountains west of Wei-hsi (June) and two males and two unsexed specimens from Tao-mung-chung.

Phylloscopus fuscatus robustus Stresemann

Abh. Ber. Mus. Tierk. Volkerk. Dresden, **16**, 1924, p. 16 (Sungpan, Sechuan).

Three specimens have been sent, two unsexed specimens from Tao-mung-chung (April or May), and a female from the mountains west of Wei-hsi (June).

Phylloscopus maculipennis debilis (Thayer and Bangs)

Reguloides maculipennis debilis Thayer and Bangs, Mem. Mus. Comp. Zoöl., **40**, 1912, p. 180 (Kiating, Sechuan).

Single male specimens come from Tao-mung-chung (April or May), Shwe-men-kan (January) and a female from Mt. Satseto (February).

Phylloscopus reguloides davisoni (Oates)

Acanthopneuste davisoni Oates, Faun. Brit. Ind., **1**, 1889, p. 420 (Tenasserim).

I have followed Stuart Baker[1] in retaining the name *davisoni* in the belief that to change the name to *flavolivaceus* (Hume) would confuse matters unnecessarily. It is a question as to whether *flavolivaceus* (Hume) is really a synonym of *Phylloscopus reguloides reguloides* (Blyth) as Baker believes.[2]

Two unsexed specimens come from Su-wa-tong, Tibet, (July).

[1] Faun. Brit. Ind., 8, 1930, p. 643.
[2] Faun. Brit. Ind., 7, p. 189.

Phylloscopus reguloides claudiae (La Touche)

Acanthopneuste trochiloides claudiae La Touche, Bull. B. O. C., **43**, 1922, p. 22 (Mengtz, Yunnan).

Rock has sent nine males, a female and three unsexed specimens from Tao-mung-chung (April or May); four males and a female from Chou-yu-gko (April); a pair and two unsexed specimens from the mountains of Tung-la (To-la) (August); a male from Su-wa-tong, Tibet, (July), and an unsexed specimen from the Tse-chung mountains (August or September).

Phylloscopus proregulus forresti Rothschild

Novit. Zoöl., **28**, 1921, p. 45 (Likiang Range, Yunnan).

Rock has sent four males, two females and an unsexed specimen from Tao-mung-chung (April or May), a pair and one unsexed specimen from Chou-yu-gko (April), and a female from the mountains of Tung-la (To-la) (August).

Phylloscopus nitidus saturatus (Stuart Baker)

Acanthopneuste nitidus saturatus Stuart Baker, Bull. B. O. C., **44**, 1924, p. 62 (Daban, South Annam).

A male comes from Chou-yu-gko, a pair from Champutong (Chamutang) (July), and a male and two unsexed specimens from Su-wa-tong (July).

Phylloscopus affinis (Tickell)

Motacilla affinis Tickell, Journ. Asiat. Soc. Bengal, **2**, 1833, p. 576 (Borabhum).

These birds are much greener below than *Phylloscopus subaffinis* (Grant); they are smaller than *Phylloscopus armandii* (Milne-Edwards) and the under wing coverts are whiter than either of them.

One male and one unsexed specimen come from Tao-mung-chung (April or May).

Phylloscopus magnirostris Blyth

Journ. Asiat. Soc. Bengal, **12**, 1843, p. 966 (Calcutta).

These specimens are darker on the head and back than *Phylloscopus b. borealis* (Blas.) but they appear to be but little more green below.

A male and an unsexed specimen were taken at Tao-mung-chung and two males and a female at Chou-yu-gko (April).

Phylloscopus pulcher vegetus (Bangs)

Reguloides pulcher vegetus Bangs, Proc. Biol. Soc. Wash., **26**, 1913, p. 95 (Chiakim, West Sechuan).

A male was taken in the mountains of Tung-la (To-la) (August), a pair from Chou-yu-gko (April), and two females and two unsexed specimens from Su-wa-tong, Tibet, (July).

There is insufficient Indian material at hand for comparison. This series is very slightly darker and greener below than the type of *vegetus*.

Abroscopus schisticeps ripponi (Sharpe)

Cryptolopha ripponi Sharpe, Bull. B. O. C., **13**, 1902, p. 11 (Gyi-dzin-shan, Yunnan).

A pair was taken at Mt. Satseto in December, four unsexed specimens come from the mountains west of Wei-hsi (June) and a single unsexed bird from Tao-mung-chung, taken in April or May.

Seicurus burkii distinctus (La Touche)

Cryptolopha burkii distincta La Touche, Bull. B. O. C., **43**, 1922, p. 41 (Mongtz, Yunnan).

Two males, a female and an unsexed specimen come from the mountains west of Wei-hsi (June), two unsexed specimens from west of Wei-hsi (June), a pair from Chou-yu-gko, a male from Tao-mung-chung (April or May), an unsexed specimen from the mountains of Tse-chung (August or September), and an unsexed specimen from Su-wa-tong, Tibet, (July).

Outram Bangs has published a paper on the *burkii* form-circle[1] in which he has gone into the characters of this group very thoroughly. The *distinctus* group is smaller than *Seicurus b. valentini* (Hartert).

Seicurus burkii valentini (Hartert)

Cryptolopha burkii valentini Hartert, Vög. Pal. Faun., **1**, 1907, p. 497 (Tai-pai-shan).

A male from Tao-mung-chung (April or May) appears to be intermediate between *valentini* and *distinctus*. Although it is as large as *valentini*, it has the crown stripes blacker than typical specimens of that form, approaching more closely to *distinctus*.

Rock has sent two males from Tao-mung-chung and five males from Chou-yu-gko (April).

[1]Proc. N. E. Zoöl. Soc., 11, 1929, pp. 1–5.

Homochlamys major (Hors. and Moore)

Cat. Birds Mus. E. Ind. Co., **1**, 1854, p. 323 (Nepal).

This species has been sent only from Su-wa-tong, Tibet, (July). The series consists of only three specimens, two males and one unsexed example.

Culicicapa ceylonensis antioxcentior Oberholser

Smithsonian Misc. Coll., **74**, July 1923, p. 69 (Tenasserim).

Culicicapa c. orientalis Stuart Baker, Bull. B. O. C., **44**, Nov. 1923, p. 12.

Five males and four unsexed specimens were taken at Tao-mung-chung in April or May, a single unsexed specimen at Wei-hsi in June, a female and an unsexed specimen at Chou-yu-gko in May, an unsexed specimen at the mountains of Tse-chung in August or September.

Chelidorhynx hypoxanthum (Blyth)

Rhipidura hypoxantha Blyth, Journ. Asiat. Soc. Bengal, **12**, 1843, p. 935 (Darjiling).

Rock took a single female at Chou-yu-gko in May, seven males, two females and four unsexed immature specimens at Su-wa-tong, Tibet, in July. He also secured a single unsexed specimen at the mountains of Tung-la (To-la) in August.

Eumyias thalassina thalassina (Swainson)

Muscicapa thalassina Swainson, Nat. Lib., **17** (Flycatchers), 1838, p. 252 (India).

Four males were taken at Tao-mung-chung (April or May), three females and an immature specimen west of Wei-hsi in June and an unsexed specimen in the mountains of Tse-chung in August or September.

Siphia strophiata strophiata Hodgson

Indian Rev., **1**, 1837, p. 651 (Nepal).

Two males come from Tao-mung-chung (April or May), four males and two females from Chou-yu-gko (May), a male and two females from Su-wa-tong, Tibet, (July) and a male, three females and seven immature specimens in the spotted plumage were taken at the mountains of Tung-la (To-la) in August.

Siphia parva albicella (Pallas)

Muscicapa albicella Pallas, Zoög. Russo-Asiat., **1**, 1827, p. 462 (Dauria).

A single specimen, a male, comes from Tao-mung-chung (April or May).

Muscicapula tricolor tricolor (Hodgson)

Digenea tricolor Hodgson, Proc. Zoöl. Soc. London, 1845, p. 26 (Nepal).

Two males and three females were taken at Chou-yu-gko in April and a female and two immature specimens at the mountains of Tung-la (To-la) in August.

Muscicapula saphira Blyth

Journ. Asiat. Soc. Bengal, **12**, 1843, p. 939 (Sikkim).

A single male specimen was taken west of Wei-hsi in June. Anderson recorded one male from Ponsee and Forrest sent two males to Rothschild. I cannot find that any more than these three birds have ever been taken in Yunnan.

Muscicapula hyperythra (Blyth)

Muscicapa hyperythra Blyth, Journ. Asiat. Soc. Bengal, **11**, 1842, p. 885 (India).

Three males were taken at Tao-mung-chung in April or May and a single female at Chou-yu-gko in April.

Muscicapula hodgsonii (Verreaux)

Siphia hodgsonii Verreaux, Nouv. Arch. Mus. Paris, Bull., **6**, 1871, p. 34 (Moupin).

Of a fine series of thirty-nine birds there are one male, two females and four immature birds from the mountains of Tung-la (To-la), taken in August, eight males and fifteen females from Chou-yu-gko (April), seven males and two females from Tao-mung-chung (April or May).

Muscicapula vivida oatesi (Salvadori)

Niltava oatesi Salvadori, Ann. Mus. Civ. Genova, **5**, 1887, p. 514 (Pegu).

Rock has sent a good series of three males from Tao-mung-chung (April or May), two males and five females from Chou-yu-gko (April),

and a female and five immature specimens, three of which appear to be males, from the mountains of Tung-la (To-la) in August.

Muscicapula superciliaris aestigma (Gray)

Muscicapa aestigma Gray, Cat. Mamm. Birds Nepal, 1846, pp. 90, 155 (Nepal).

Four males come from Tao-mung-chung (April or May).

Hemichelidon sibirica rothschildi Baker

Bull. B. O. C., **43**, 1923, p. 156 (Yunnan).

Rock obtained two males from Chou-yu-gko in May, a male, three females, an unsexed specimen and two immature birds in the spotty plumage from the mountains of Tung-la (To-la) in August.

Hemichelidon ferruginea Hodgson

Proc. Zoöl. Soc. London, 1845, p. 32 (Nepal).

Three males, a female and one unsexed specimen have been sent from Chou-yu-gko (April).

Niltava sundara denotata Bangs and Phillips

Bull. Mus. Comp. Zoöl., **58**, 1914, p. 280 (Mongtz, Yunnan).

Two males come from west of Wei-hsi (June) and Tao-mung-chung (April or May); a pair and an immature male and two females were taken at the mountains of Tung-la in August.

Niltava macgrigoriae (Burton)

Phoenicura macgrigoriae Burton, Proc. Zoöl. Soc. London, 1835, p. 152 (Himalayas).

A single specimen was taken at Champutong (Chamutang) in July.

Rhipidura albicollis albicollis (Vieillot)

Platyrhynchus albicollis Vieillot, Nouv. Dict. d'Hist. Nat., **27**, 1818, p. 13 (Bengal).

Rock has sent three males, two from the mountains of Tse-chung (August or September) and one from Mt. Satseto (December).

Pericrocotus brevirostris styani Baker

Bull. B. O. C., **40**, 1920, p. 117 (Sechuan).

Six males and five females come from Tao-mung-chung (April or May) and a male and two females from Chou-yu-gko (April) and a single female from the mountains of Tung-la (To-la) (August).

In his description Stuart Baker says that the males are not distinguishable from *affinis*. This series, however, is much lighter than spring birds from Loukouchai and Militi, south Yunnan, being strikingly lighter below. They resemble *brevirostris*. The females, however, are greener on the back and have much less yellow on the forehead than that form and are otherwise quite like the description of *styani*.

Lalage melaschista avensis Blyth

Cat. Birds Asiat. Mus., 1854, p. 327 (Arakan). (Described in Journ. Asiat. Soc. Bengal, **15**, 1846, p. 307.)

Two males come from Chou-yu-gko (April).

Microscelis leucocephalus leucocephalus (Gmelin)

Turdus leucocephalus Gmelin, Syst. Nat., **1**, 1789, p. 826 (China).

In a series of ten specimens, three males from Tao-mung-chung (April or May) one female west of Wei-hsi (June), one male from Champutong (July), and one male, two females and two immature specimens from the mountains of Tse-chung (August or September), there is not one referable to *Microscelis l. concolor* Blyth. They are slightly larger, the males measure: wing 121 to 124 mm., as against 115 to 118 mm. for the male specimens of *concolor* in the Museum of Comparative Zoölogy. Furthermore none of them have the blue gray sheen to the feathers of the breast that is characteristic of *concolor*. There is a perfect intermediate specimen between *concolor* and *leucocephalus* in the series of the Museum of Comparative Zoölogy, which has the blue gray sheen on the breast as well as a pure white head and neck. Rock took *leucocephalus* in the Likiang Range in 1925.[1]

[1] Proc. U. S. Nat. Mus., **70**, 1926, p. 21.

Ixos mcclellandi similis (Rothschild)

Iole mcclellandi similis Rothschild, Novit. Zoöl., **28**, 1921, p. 51 (Schweli-Salween Divide).

Comparison of specimens of the same sex of *Ixos m. holti* (Swinh.) and *Ixos m. similis* (Roths.) taken in the same months in Fukien and Mongtz discloses that the south Yunnan bird has slightly yellower under tail coverts. Three specimens, a pair and a bird of the year just out of the nest, taken at Champutong in July by Rock, are much more clearly referable to *similis*, being lighter below and having the tail coverts much lighter yellow.

The bills of these three birds are larger than those of either *holti* or *similis*. This difference is noticeable also in the nestling when compared with a nestling in the collections of the Museum of Comparative Zoölogy, which was taken in August at Mongtz.

Spizixos canifrons canifrons Blyth

Journ. Asiat. Soc. Bengal, **14**, 1845, p. 571 (Cherra Punji).

There are no specimens of the Indian or Burmese bird at hand for comparison and therefore I cannot say whether this bird has a gray or a brown throat. In a long series from south Yunnan and Sechuan in the Museum of Comparative Zoölogy the throats of the mature birds are gray, or perhaps brownish gray by a slight stretch of the imagination. None are dark brownish gray as described by Stuart Baker and so figured.[1]

Since Rothschild [2] considers that the character of the greenness or yellowness of the underparts is due to age or individual difference and my own comparison of the Chinese specimens in the Museum of Comparative Zoölogy has led me to the same conclusion, I follow him in considering the Yunnan bird identical with the Indian and Burmese.

Three birds, two males and a female come from the Likiang Mountains and were taken in February. A fourth is apparently an immature female and was taken in the same place in December. This specimen is much darker below than the others.

[1] Faun. Brit. Ind., 1, p. 400.
[2] Novit. Zoöl., 28, 1921, p. 50.

Pycnonotus aurigaster xanthorhous Anderson

Proc. Asiat. Soc. Bengal, 1869, p. 265 (Kakhyen Hills).

A single male specimen was taken at Tao-mung-chung in April or May.

Lanius tephronotus (Vigors)

Collurio tephronotus Vigors, Proc. Zoöl. Soc. London, 1831, p. 43 (Himalayas).

Five males and three females were taken at Tao-mung-chung in April or May and three males at Chou-yu-gko in May.

Conostoma aemodium aemodium Hodgson

Journ. Asiat. Soc. Bengal, **10**, 1841, p. 857 (Nepal).

There is a good deal of individual variation in the measurement of the wings of this series, the males measuring 121–136 and the females 118–134. There is, of course, a good deal of doubt about the sexing done by the native collectors that Rock employs, but the females seem to be slightly smaller than the males.

Three males and two females were taken at Tao-mung-chung (April or May); three males and a single female at Chou-yu-gko (April); three males and one unsexed specimen at Mt. Satseto (December); and two pairs at Shwe-men-kan (February).

Paradoxornis guttaticollis David

Nouv. Arch. Mus. Paris, Bull., **7**, 1871, p. 14 (W. Sechuan).

Only two females, one from Tao-mung-chung and the other from Chou-yu-gko, are in this series.

Suthora unicolor canaster Thayer and Bangs

Mem. Mus. Comp. Zoöl., **40**, 1912, p. 117 (Washan, Sechuan).

Four males, six females and two unsexed specimens come from Mt. Gyi-na-loko (October or November), a single female from Champutong (Chamutang) (April), two females and an unsexed specimen from Shwe-men-kan (January) and a pair from Yung-ning (February).

Suthora fulvifrons cyanophrys David

Journ. Trois Voy. Chine, **1**, 1875, p. 345 (Shensi meridional).

Four males, three females and four unsexed specimens come from Tao-mung-chung, two males and three unsexed specimens from Chou-yu-gko, and six males, five females and five unsexed specimens from Mt. Satseto.

Suthora webbiana ricketti (Rothschild)

Paradoxornis webbiana ricketti Rothschild, Bull. B. O. C., **43**, 1922, p. 11 (Yangtze Valley, Yunnan).

Three males and a single female come from Mt. Satseto (December).

Suthora webbiana brunnea Anderson

Proc. Zoöl. Soc. London, 1871, p. 211 (Western Yunnan).

I have followed Stuart Baker [1] in recording this bird as a subspecies of *webbiana*. Although Rothschild records [2] it as a distinct species, there seems to be no evidence that the two birds have been found breeding in the same locality.

Five adult specimens in the present series are lighter below than a single specimen of *brunnea* from Burma that I have for comparison. They are, however, in worn plumage while the single specimen in the collection of the Museum of Comparative Zoölogy is old and probably has darkened with time.

Three males, a female and three immature specimens come from west of Wei-hsi and east of the Mekong River (June) and a single female comes from Champutong (Chamutang) (July).

The violet color of the throat in the immature specimens is somewhat lighter.

Regulus regulus yunnanensis Rippon

Bull. B. O. C., **19**, 1906, p. 19 (W. Yunnan).

A male, three females and three unsexed specimens come from Mt. Satseto (February).

[1] Faun. Brit. Ind., 7, 1930, p. 21.
[2] Novit. Zoöl., 33, 1926, p. 310.

Aegithaliscus bonvaloti bonvaloti (Oustalet)

Acredula bonvaloti Oust., Ann. Sci. Nat. Zoöl., **12**, 1891, p. 286 (Ta-tsien-lu).

Seven males and three females come from Tao-mung-chung (April or May), two males and one female from Chou-yu-gko (April), four males and one female from Mt. Satseto (February), and single males from west of Wei-hsi (June), mountains of Tung-la (To-la) (August) and Mt. Gyi-na-loko (October or November).

Aegithaliscus concinnus talifuensis Rippon

Bull. B. O. C., **14**, 1903, p. 18 (Gyi-dzin-shan, N. Shan States).

Two males were taken at Tao-mung-chung in April or May, and a male, two females and two immature specimens from west of Wei-hsi in June.

Stuart Baker remarks [1] that this form is very doubtfully distinct from *Aegithaliscus c. concinnus* (Gould) from China and Yunnan. I find that in comparison with ten specimens taken in the spring in eastern China (Fukien and Sechuan), the Yunnan birds have the buffy brown of the pectoral band and the head a little darker. Birds from Mongtz in southern Yunnan seem to be identical with those from N. W. Yunnan.

Sylviparus modestus saturatior Rippon

Bull. B. O. C., **16**, 1900, p. 87 (Mt. Victoria, Chin Hills).

Three males and two females come from Tao-mung-chung (April or May), a male from Su-wa-tong, Tibet, taken in July and an unsexed specimen from the mountains of Tung-la (To-la) (August), and two males and a female from Mt. Satseto (December).

Parus dichrous wellsi Baker

Bull. B. O. C., **38**, 1917, p. 8 (Yangtze Big Bend).

Six males and a female were taken at Chou-yu-gko in April; a single male at Tao-mung-chung in April or May; two unsexed specimens at Su-wa-tong, Tibet, in July; two males and an unsexed specimen at the mountains of Tung-la (To-la) in August; a male at Mt. Gyi-na-loko in October or November, an unsexed specimen at Mt. Satseto in Decem-

[1] Faun. Brit. Ind., 1, 1922, p. 95.

ber; eight males, two females and four unsexed specimens at Shwe-men-kan in January and three males and a female at Mt. Satseto in February.

Parus rufonuchalis beavani (Jerdon)

Lophophanes beavani Jerdon, Birds of India, **2**, 1863, p. 275, ex. Blyth MS. (Mt. Teringloo, Sikkim).

Two males and a female were taken at Chou-yu-gko in April; a single male at Su-wa-tong, Tibet, in July; a male and four females at Mt. Gyi-na-loko in October or November; two males, four females and two unsexed specimens from Shwe-men-kan in January and a single male from the east slopes of the Likiang Snow Range in February.

Parus ater aemodius Blyth

Journ. Asiat. Soc. Bengal, **13**, 1844, p. 943 (Nepal).

A single male comes from Tao-mung-chung (April or May), a male, three females and an unsexed specimen from Chou-yu-gko (April); an immature specimen comes from west of Wei-hsi in June. A single male from Mt. Satseto, taken in February has a wing measurement of 64 mm. It differs in no other way from the spring specimens and I have concluded that it is simply an abnormally large specimen.

Parus monticolus yunnanensis La Touche

Bull. B. O. C., **42**, 1921, p. 51 (S. E. Yunnan).

Four males and a female were taken at Tao-mung-chung in April or May; three males and two females at Chou-yu-gko in April; a single unsexed specimen at Su-wa-tong, Tibet, in July; and a male and three unsexed specimens in the mountains of Tung-la (To-la) in August.

These specimens have the underparts very slightly greener than six specimens of the Indian bird in the Museum of Comparative Zoölogy. I can find no other difference.

Parus palustris dejeani Oustalet

Bull. Mus. Hist. Nat. Paris, **3**, 1897, p. 209 (Ta-tsien-lu).

Two males come from Tao-mung-chung, a single female from Chou-yu-gko (April) and a single male from the Likiang Snow Range (February).

Parus major altarum La Touche

Bull. B. O. C., **42**, 1922, p. 53 (Yunnan).

Two specimens, one a female (sexing?) from the Likiang Snow Range (February) and one unsexed specimen from west of Wei-hsi (June) have been sent.

Cephalopyrus flammiceps olivaceus Rothschild

Novit. Zoöl., **30**, 1923, p. 263 (Vicinity of Tengueh).

Three males were taken at Tao-mung-chung in April or May.

Sitta yunnanensis Grant

Bull. B. O. C., **10**, 1900, p. 37 (Wei-Yuan).

Two unsexed examples come from west of Wei-hsi (June), a male from the Likiang Range (February) and a male from Mt. Gyi-na-loko (October or November).

Sitta europaea nebulosa La Touche

Bull. B. O. C., **42**, 1921, p. 30 (S. E. Yunnan).

Rock has sent a fine series. Five males and a female come from Tao-mung-chung (April or May); three males from Chou-yu-gko (April), two males, a female and two unsexed specimens from the mountains of Tung-la (To-la) (August); a single male from the mountains of Tse-chung (August or September); three unsexed specimens from Su-wa-tong, Tibet, (July), a male, a female and an unsexed specimen from Mt. Gyi-na-loko (October or November); three males and a female from Mt. Satseto in February and a pair from the east slopes of Mt. Satseto in March.

The type of *nebulosa* which is in the Museum of Comparative Zoölogy was taken in southern Yunnan (Milati) in February and is very gray below as are all the winter birds in the collections of the Museum of Comparative Zoölogy and the specimens in the series that Rock has just sent. Spring and summer birds are much lighter and browner, less gray.

Tichodroma muraria (Linnaeus)

Certhia muraria Linn., Syst. Nat. edit. 12, **1**, 1766, p. 184 (South Europe).

A single male comes from Mt. Gyi-na-loko (October or November).

Certhia himalayana yunnanensis Sharpe

Bull. B. O. C., **13**, 1902, p. 11 (Yunnan).

Two males, two females and an unsexed specimen come from Tao-mung-chung (April or May), a male from the mountains of Tung-la (To-la) (July), a single female from Mt. Gyi-na-loko (December) and a pair and an unsexed specimen from Mt. Satseto (February).

Certhia familiaris khamensis Bianchi

Bianchi in Sharpe's Hand List of B., **4**, 1893, pp. 355, 360 (Kham).

A male comes from the mountains of Tung-la (To-la) (August), an unsexed immature bird from Su-wa-tong, Tibet, (July), two males and an unsexed specimen from Mt. Gyi-na-loko (October or November) and a male from the eastern slopes of the Likiang Snow Range (February).

Zosterops simplex simplex Swinhoe

Proc. Zoöl. Soc. London, 1862, p. 317 (S. E. China).

A male, seven females and five unsexed specimens were taken at the mountains west of Wei-hsi in June and a single unsexed example at Su-wa-tong, Tibet, in July.

Pachyglossa melanoxantha Hodgson

Journ. Asiat Soc. Bengal, **12**, 1843, p. 1010 (Nepal).

A male and two females were taken at Chou-yu-gko in April.

Aethopygia ignicauda exultans Baker

Bull. B. O. C., **46**, 1925, p. 13 (Schweli-Salween Divide, w. central Yunnan).

A series of twelve males, an unsexed specimen (young male) and six females were shot at Su-wa-tong, Tibet, in July.

Aethopygia dabryi (Verreaux)

Nectarinia dabryi Verreaux, Rev. et Mag. Zoöl., 1867, p. 173 (Ta-tsien-lu, Sechuan).

Eight males and five females were taken at Tao-mung-chung in April or May. Five pairs were taken at Chou-yu-gko in April, a pair

at Champutong (Chamutang) in July and a single male at Wei-hsi in June; a young bird just out of the nest was taken at Su-wa-tong, Tibet, in July.

Motacilla alboides Hodgson

Asiat. Res., **19**, 1836, p. 191 (Nepal).

Rock has sent three males and two females from Tao-mung-chung (April or May). I have followed Stuart-Baker in considering all forms of the black backed group as distinct species.

Motacilla leucopsis Gould

Proc. Zoöl. Soc., London, 1837, p. 78 (India).

A single specimen comes from Tao-mung-chung (April or May). It is a male.

Motacilla cinerea caspica (Gmelin)

Parus caspicus Gmelin, Reise Russ. Reichs., **3**, 1774, p. 104, pl. 20, fig. 2 (Caspian Sea).

A single male specimen was sent from Tao-mung-chung (April or May). It is just beginning to molt out of winter plumage.

Anthus hodgsoni yunnanensis Uchida and Kuroda

Annot. Zoöl. Japan, **9**, 1916, p. 134 (Yunnan).

Four males and three females were taken at Chou-yu-gko in May and two males at Mt. Gyi-na-loko in October or November. The autumn birds are very much darker. The back is green not grayish green and the yellow of the throat is darker and more buffy.

Anthus roseatus Blyth

Journ. Asiat. Soc. Bengal, **16**, 1847, p. 437 (Nepal).

Rock took two pairs at Tao-mung-chung in April or May.

Alauda gulgula weigoldi Hartert

Abh. u. Ber. d. Zoöl. Anthr. Ethn. Mus. zu Dresden, **15**, 1922, no. 3, p. 20 (Hankow).

A male, a female and an unsexed specimen were taken at Tao-mung-chung in April or May. Their wings measure 101, 101 and 106

. . . the extreme of size given for *weigoldi.* I can find very little difference in size between the short-winged larks of south and north China.

I prefer to follow Stuart Baker in retaining *gulgula* for the short-winged birds.

Emberiza pusilla Pallas

Reise Russ. Reichs., **3**, 1776, p. 697 (Daurian Alps).

Six males, a female and one unsexed specimen come from Tao-mung-chung (April or May).

Emberiza fucata arcuata Sharpe

Cat. Birds Brit. Mus., **12**, 1888, p. 494 (Himalayas).

A pair was taken in the mountains west of Wei-hsi in June. They are in worn breeding plumage. They are as dark as a cotype of *Emberiza f. kuatunensis* La Touche (taken in April), but the chestnut borders of the feathers of the median coverts and the lesser coverts are worn and faded so that the appearance of the bird is somewhat changed.

Emberiza spodocephala melanops Blyth

Journ. Asiat. Soc. Bengal, **14**, 1845, p. 554 (Tippera).

Four males and a female (sexing?) were taken west of Wei-hsi in June.

The breeding range that Sushkin has given [1] for this bird should be extended to include Yunnan. In spite of the fact that there is no direct evidence that these birds were breeding in western Yunnan, it is very probable that they were, since they were taken there in June. For this reason it may not be that all birds breeding west of Sechuan are *Emberiza s. spodocephala* (Pallas).

Emberiza elegans elegantula Swinhoe

Proc. Zoöl. Soc. London, 1870, p. 134 (Kweichow, Hupeh).

Eleven males and three females (young males?) were taken at Tao-mung-chung in April or May, two pairs and four immature specimens (unsexed) from west of Wei-hsi in June; a single male comes

[1] Proc. Soc. Nat. Hist., Boston, **38**, 1925, p. 28.

from the Likiang Snow Range in March and a single immature specimen from Champutong in July.

A single nestling specimen of what appears to be this form was taken at Su-wa-tong, Tibet, in August.

Emberiza aureola Pallas

Reise Russ. Reichs., **2**, 1773, p. 711 (Irtysh).

Two males and two unsexed specimens (females?) were taken at Tao-mung-chung in April or May.

Emberiza godlewskii yunnanensis Sharpe

Bull. B. O. C., **13**, 1902, p. 12 (Talifu, Yunnan).

Three males come from Tao-mung-chung (April or May); two males from Chou-yu-gko (May) and three males and an unsexed specimen from Mt. Satseto (February).

I have followed Sushkin in his treatment of this group. From a comparison of the specimens in the Museum of Comparative Zoölogy it would appear that he is right in considering the *cia* group, characterized by a black stripe behind the ear coverts, and the *godlewskii* group with the comparatively broad chestnut stripe, as distinct species.

Passer rutilans intensior Rothschild

Bull. B. O. C., **43**, 1922, p. 11 (Mekong Valley).

Two pairs were taken west of Wei-hsi in June; two males at Tao-mung-chung in April or May, and single females at Champutong in July and at Mt. Satseto in December.

Fringilla montifringilla Linnaeus

Syst. Nat., 10th Ed., **1**, 1759, p. 179 (Sweden).

Two females were taken at Mt. Satseto in October or November, and two females and an unsexed specimen at Tao-mung-chung in April or May.

Procarduelis nipalensis intensicolor Baker

Bull. B. O. C., **45**, 1925, p. 92 (Yunnan).

Three males come from Mt. Gyi-na-loko (October or November),

three pairs from Mt. Satseto (December and February), and eleven females from Su-wa-tong, Tibet, (July).

Procarduelis rubescens saturatior Rothschild

Bull. B. O. C., **43**, 1922, p. 12 (Likiang Range, Yunnan).

Five males and five females come from Shwe-men-kan (January), a male from Mt. Satseto (January), a male from Mt. Gyi-na-loko (October or November) and a male from Mt. Satseto (January).

Propyrrhula subhimachala intensior Rothschild

Bull. B. O. C., **43**, 1922, p. 12 (Likiang Range).

A single specimen, male, was taken at Mt. Gyi-na-loko in November or December.

Erythrina thura feminina (Rippon)

Carpodacus femininus Rippon, Bull. B. O. C., **19**, 1906, p. 31 (Western Yunnan).

Rock has sent a fine series of thirty-seven skins. Three males and ten females were taken at Mt. Gyi-na-loko in November and December; five males and eleven females at Shwe-men-kan in January and two males and five females on the east slopes of the Likiang Snow Range near Mt. Satseto in January or February and a single female from the mountains of Tung-la (To-la) in July.

Females from the same locality have the rump a very deep reddish brown or a rather lighter brown. This seems to me to be an individual variation.

Erythrina verreauxi (Dav. and Oust.)

Propasser verreauxi Dav. and Oust., Ois. de la Chine, 1877, p. 355 (China).

A pair was taken at Mt. Gyi-na-loko in October or November; three males and two females at Mt. Satseto in December and a male and two females in February; single females come from Shwe-men-kan (January), Su-wa-tong, Tibet, (July), and the mountains of Tung-la (To-la) (August).

I have followed Berlioz in relegating the name *Erythrina ripponi* (Sharpe) to synonymy.

Erythrina pulcherrima argophrys (Berlioz)

Carpodacus argophrys Berlioz, Bull. Mus. Paris, ser. 2, **1**, 1929, p. 131 (Ta-tsien-lu and Tseku, Sechuan).

A pair was taken on the Likiang Range in February; single females on the slopes of Mt. Gyi-na-loko in October or November, Mt. Satseto in March and Tao-mung-chung in April or May.

I have followed Stresemann [1] in the identification of the *pulcherrima* group. He has apparently examined most of the known material in Europe.

Erythrina eos Stresemann

Orn. Monats., **38**, 1930, p. 75 (Sungpan, Sechuan).

A single specimen was taken in the mountains of Tung-la (To-la) in August.

The wing tip of this specimen measures 12 mm. and the wing measures 74 mm., as against 24 mm. and 87 mm. for the specimens that I have identified as *Erythrina pulcherrima argophrys* Berlioz.

Erythrina edwardsii rubicunda subsp. nov.

Type.—M. C. Z. No. 159,303, taken at Su-Wa-Tong, Tibet, on the upper slopes of the Mt. Kenichunpo or Gomba-La, east slopes of the Salween-Irawaddy Divide, 14,000 ft.

Closest to *Erythrina edwardsii saturatus* (Blanford) but the head is maroon rather than pink with greenish reflections; edges of the feathers of the back are reddish brown, without the hint of green; the throat is a more purplish red and the breast is maroon only very slightly lighter than the head; the belly is pink but without any yellowish tinge. The effect is such that the bird is noticeably darker and redder than the Indian Bird. The female also is much darker above, the dark shafts of the feathers being so close together that it appears almost to be black. Below, the shafts of the feathers are black rather than dark brown and the edges of the feathers are a darker brown.

Description.— Head maroon; a broad light pink stripe running from just above and before the eye to the neck; lores dark brown; ear coverts maroon like the head; feathers of the back with a broad black shaft stripe, the edges reddish brown; tail coverts maroon like the head; tail

[1] Orn. Monats., **38**, 1930, p. 72.

feathers dull brown, the outer webs of the outer three narrowly edged with reddish brown. Below, brown; throat and breast purplish red with black shaft lines to the feathers; belly rose pink; thighs have a brownish tinge, giving a bronze effect; primary coverts brown, the outer webs narrowly edged with reddish bronze and tipped with pink; primaries and secondaries brown, the outer webs narrowly edged with reddish bronze.

Rothschild[1] remarked as follows on a specimen of *Erythrina edwardsii saturatus* (Blanf.) from Yunnan: "The adult male is much darker than any of my Chinese birds, and is even darker than any specimen from Nepal and Sikkim that I possess, so it may prove to be a third race when more Yunnan material comes to hand."

Rock has sent a series of four males and eight females from Su-wa-tong, Tibet, taken in July and a series of one male and eight females taken in the Likiang Snow Range in the vicinity of Mt. Satseto at altitudes varying from 9,000 to 14,000 ft. in October, November, December, January, February.

Erythrina vinacea rubidior subsp. nov.

Type No. 159,258 Museum Comparative Zoölogy from the mountains of Tung-la (To-la).

This bird is like *Erythrina v. vinacea* (Verreaux) but darker. The deeper, almost blackish, red is more noticeable on the upper breast. The female is markedly darker than females from Sechuan.

Rock has sent a pair from the mountains of Tung-la (To-la) taken in July, a female from Su-wa-tong, taken in August and a male from Mt. Gyi-na-loko, taken in October or November.

These specimens have been compared with three males and two females from Sechuan in the collections of the Museum of Comparative Zoölogy, one male from the La Touche collection without data other than the locality "Sechuan," a male from Washan, Sechuan, (May), and another from Chetze, Hupeh, (December); both females are from Washan.

If the type locality of *Erythrina v. vinacea* (Verr.) is really "Mountains of Chinese Tibet" as Hartert and Rothschild have recorded it, it would seem very improbable that we should now find a race on the border of Tibet and Yunnan. I think, however, that the type locality is actually Ho-pa-tchang, "a journey of a day and a half

[1] Novit. Zoöl., 33, 1926, p. 332.

north of Chengtu, Sechuan," and that David shot his birds in that district only.[1] I believe that birds from Kansu, Yunnan and eastern Tibet are geographical representatives, a western race of *vinacea*.

Carpodacus erythrina roseatus (Blyth)

Propasser roseatus Blyth, (ex Tickell) Journ. Asiat. Soc. Bengal, **11**, 1842, p. 401 (Calcutta).

Two males and a female come from Tao-mung-chung (April or May).

Pyrrhula erythaca altera Rippon

Bull. B. O. C., **19**, 1906, p. 19 (West Yunnan).

Rock has sent a fine series of thirty-one skins. A male and six females come from Tao-mung-chung (April or May); single females were taken at Chou-yu-gko (May) and the mountains of Tung-la (To-la) in August; four males and fourteen females come from Mt. Satseto (January or February). Two males and three females from Mt. Gyi-na-loko (October or November).

The throat of one of the males taken at Mt. Satseto is suffused with red and another has the breast quite green with only a few inconspicuous reddish-orange feathers. None of these specimens have the breast vermilion as has a single topotype of *Pyrrhula e. taipaishanensis* Roths. in the collections of the Museum of Comparative Zoölogy. There are specimens from Sechuan, apparently immature, taken in September in the La Touche collection which have the breast suffused with greenish-yellow as the single specimen that Rock has sent. I am, therefore, inclined to believe that this coloration is due to age or perhaps to the character of the food or to a combination of both.

Pyrrhula nipalensis ricketti La Touche

Bull. B. O. C., **16**, 1905, p. 21 (Mountains of N. W. Fukien).

A male and two females were taken in the mountains of Tung-la (To-la) and a single female in the mountains of Tse-chung, all in August.

[1] Nouv. Arch. Mus. Paris, Bull., **7**, 1871, p. 61; *ibid*, **8**, 1873, pp. 22–26.

Pyrrhoplectes epauletta (Hodgson)

Pyrrhula epauletta Hodgs., Asiat. Res., **19**, 1836, p. 156 (N. and C. Nepal).

Twelve males and four females come from Su-wa-tong, Tibet, (July). These birds appear to be identical with the specimens from the Himalayas in the Museum of Comparative Zoölogy.

Spinus thibetanus (Hume)

Chrysomitris thibetanus Hume, Ibis, 1872, p. 107 (Sikkim).

A pair was taken at Mt. Gyi-na-loko in October or November.

I cannot find that this bird has ever been taken in Yunnan before.

Hypacanthis ambiguus (Oustalet)

Chrysomitris ambigua Oustalet, Bull. Mus. Paris, **2**, 1896, p. 186 (Yunnan).

Two females come from Tao-mung-chung (April or May) and four males, a single female from Mt. Satseto (February) and an immature specimen from Champutong (July).

The differences in color pattern between this bird and *Hypocanthis s. spinoides* (Vigors) are so great that I prefer to consider them as distinct species.

Perissospiza icteroides affinis (Blyth)

Hesperiphona affinis Blyth, Journ. Asiat. Soc. Bengal, **24**, 1855, p. 179 (Alpine Punjab).

Rock has sent a series of nine birds. A male was taken at Tao-mung-chung in April or May and one on the mountains of Tung-la in August; four males and two females at Mt. Gyi-na-loko in October or November and a single female at Shwe-men-kan in January.

Perissospiza carnipes carnipes (Hodgson)

Coccothraustes carnipes Hodgson, Asiat. Res., **19**, 1836, p. 151 (Nepal).

A mature and two immature males and a female were taken at Chou-yu-gko in May; a pair at the mountains of Tung-la (To-la) in August and three females on Mt. Satseto in February.

Mycerobas melanoxanthos (Hodgson)

Coccothraustes melanoxanthos Hodgson, Asiat. Res., **19**, 1836, p. 150 (Nepal).

A single specimen, which the collector could not sex, but which appears to be a female comes from the mountains of Tung-la (To-la) (August).

Oriolus chinensis tenuirostris Blyth

Journ. Asiat. Soc. Bengal, **15**, 1846, p. 48 (Central India).

Three males and two females come from west of Wei-hsi (June), a single male from Tao-mung-chung (April or May) and a single female from the Likiang Snow Range (March).

Oriolus trailli (Vigors)

Pastor trailli Vigors, Proc. Zoöl. Soc. London, 1831, p. 175 (Darjiling).

A mature, an immature male and a female were taken at Chou-yu-gko in April.

Dicrurus macrocercus cathoecus Swinhoe

Proc. Zoöl. Soc. London, 1871, p. 377 (China).

A single specimen, a male, was shot at Tao-mung-chung in April or May.

Dicrurus leucophaeus hopwoodi Baker

Novit. Zoöl., **25**, 1918, p. 294 (Decca).

Five males and two females were taken at Tao-mung-chung in April or May and a single female west of Wei-hsi in June.

Acridotheres cristatellus cristatellus (Gmelin)

Gracula cristatella Gmelin, Syst. Nat., **1**, 1788, p. 397 (China).

A single male was taken in the Likiang Snow Range in February.

Garrulus glandarius sinensis Swinhoe

Proc. Zoöl. Soc. London, 1871, p. 381 (South China, westwards to Sechuan).

Five females (sexing ?): three were taken at Mt. Gyi-na-loko in October or November, one at Mt. Satseto in December and one at Shwe-men-kan in January.

Nucifraga caryocatactes macella Thayer and Bangs

Bull. Mus. Comp. Zoöl., **52**, 1909, p. 140 (Hsien-shan-hsien).

Three males and a female taken at Chou-yu-gko in April are immature, another female taken at the same place at the same time is in worn plumage and the feathers of the head and back and breast have almost lost their white tips and the brown is faded. A female taken at Tao-mung-chung in April or May is in fresher plumage and a female from Champutong, taken in July is in full plumage and is very dark as are two females that were taken at Mt. Gyi-na-loko in October or November.

I cannot find that these birds differ from *macella* in any important characteristic and I believe that *Nucifraga c. yunnanensis* Ingram [1] is probably a synonym.

[1] Bull. B. O. C., 25, 1910, p. 86.

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NEW AND LITTLE KNOWN SPIDERS FROM THE UNITED STATES

By Elizabeth B. Bryant

With Four Plates

CAMBRIDGE, MASS., U. S. A.

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AT HARVARD COLLEGE

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No. 6.— *New and Little Known Spiders from the United States*

By Elizabeth B. Bryant

Recently while identifying spiders from various collections at the Museum of Comparative Zoölogy several new species and new records of distribution were found. In recent years Mr. W. S. Blatchley has sent Professor Banks collections from Dunedin and Royal Palm Park, Florida. It is not surprising to find from the latter locality four West Indian species, *Theridion rufipes* Koch, a cosmopolitan tropical species, *Trachelas bicolor* Keyserling, described from Haiti, *Corinna gracilipes* (Keyserling) also known only from Haiti, and *Pseudosparianthis cubana* Banks described from Havana, Cuba. From Brownsville, Texas, were found two Mexican species, *Metaphidippus longipalpus* Cambridge and *Miagrammopes lineatus* Cambridge, the first time that the latter genus has been found in the United States, and also *Myrmecotypus cubanus* Banks, a Cuban species originally found with ants at Soledad, Cuba.

The following species are new:

Euryopis emertoni
Euryopis ornata
Gonatium crassipalpus
Dipœna lineatipes
Trachelas laticeps
Xysticus laticeps
Xysticus trimaculatus
Philodromus montanus
Philodromus bilineatus
Philodromus emertoni
Ebo cockerelli

ULOBORIDAE

Miagrammopes lineatus Cambridge

Biol. Centr. Amer., Arachn., 1894, **1**, p. 137, pl. 17, fig. 12.

Among a small lot of spiders collected by C. Schaeffer at Brownsville, Texas, was a small *Miagrammopes* that probably is this species. It agrees with a specimen from Costa Rica in size and arrangement of eyes. It is the first time that the genus has been recorded from the United States.

THERIDIIDAE

Euryopis emertoni spec. nov.

Plate 1, fig. 1

♂ 2 mm. long.

Cephalothorax bright orange red, black about the eyes with a few short, stiff hairs in front of the quadrangle of eyes; abdomen, basal four-fifth covered with a brown scutum with many long, slender hairs from coriaceous spots; legs bright yellow with many fine hairs; sternum and coxæ orange; sternum prolonged in an obtuse lobe between the posterior coxæ; venter covered with two thickened pieces, one from the pedicle to the spiracles and the other continued to the spinnerets, nearly the width of the venter; eyes, anterior row recurved, A.M.E. slightly largest, separated by diameter and a half and from A.L.E. by less than a diameter; posterior row straight, only very little longer than anterior row, eyes subequal and equidistant, lateral eyes almost touching; quadrangle of median eyes widest in front and wider than high; clypeus about three times as high as eye area.

Palpus small, tibia less than half as long as wide, with simple rounded sides and no lobes; palpal organ very simple as figured.

Holotype (♂) Ga.; Thompson's Mills, H. A. Allard; N. Banks Coll.

This species is very close to *Euryopis spinigera* Cambridge, Biol. Centr. Amer., 1895, 1, p. 146, pl. 19, fig. 2, but differs as follows: the clypeus three not four times the eye area, a distinct scutum between the epigastric fold and the spinnerets, instead of scattered patches, and in the male palpus the narrow tibia without lobes, where in *E. spinigera* it is described and figured as "very short and spreading, produced considerably on the inner side in an obtuse form."

It is very probable that the two specimens referred to as *E. spinigera* by Mr. J. H. Emerton, in Psyche, 1924, **31**, p. 142, fig. 4 from Chatham, Massachusetts, and Charleston, South Carolina, are this species.

Euryopis ornata spec. nov.

Plate 1, figs. 2, 3

♂ 1.5 mm. long.

Cephalothorax dull gray brown, black around eyes; abdomen brownish gray with six transverse clear bands, those at the apex bent almost like chevrons; legs pale yellow without marks; sternum, venter and coxæ pale yellow; IV coxæ separated by more than a diameter;

eyes, A.M.E. largest of the eight, separated by about a diameter; lateral eyes almost touching; quadrangle of median eyes widest in front; clypeus more than twice as high as quadrangle.

Palpus very simple; tibia about as long as patella.

Holotype (♂), Miss.; Meridian, H. E. Weed, N. Banks Coll.

Euryopis ornata is much smaller than any described American species. It differs from *E. spinigera* Cambr. reported by Mr. Emerton from Chatham, Massachusetts, and Charleston, South Carolina, by the palpus and the lack of a scutum on dorsum and venter, and from *E. funebris* (Hentz) by the much smaller size, unmarked legs and palpus.

Theridion quadrimaculatum (Banks)

Plate 1, fig. 4

Mysmena quadrimaculata Banks, Trans. Amer. Ent. Soc., 1896, **23**, p. 66.

♂ 1.5 mm. long.

Cephalothorax, legs and sternum pale yellow; abdomen yellowish gray with four dark blotches as in the female, with many long hairs; venter dark in the center; sternum as broad as long; eyes; anterior row recurved, A.M.E. separated by two diameters and by one diameter from A.L.E.; posterior row, eyes subequal, procurved so that lateral eyes touch, P.M.E. separated by more than a diameter; quadrangle about as high as wide; clypeus a little higher than quadrangle of eyes.

Palpus longer than I femur, patella longer than tibia; palpal organ very simple.

Holotype (♀) Fla.; Punta Gorda, N. Banks Coll.

Allotype (♂) Fla.; Dunedin, March, 1927, W. S. Blatchley Coll.

The type of this species is a female and it was placed in the genus *Mysmena*. In 1925 Mr. Crosby examined the type and said that it did not belong to that genus. The male palpus shows that it is a *Theridion* in the sense that Simon uses the genus.

Theridion rufipes Koch

This cosmopolitan tropical spider has been found recently at Sebastian, Florida.

Gonatium crassipalpus spec. nov.

Plate 1, figs. 5, 6, 8, 9, 10

♂ 2.5 mm. long; ceph. 1.2 mm.; abd. 1.7 mm.

Cephalothorax bright brown, black around the eyes; abdomen gray;

legs orange; head elevated in eye area, sternum brown, widest between I coxæ and almost as wide as long, extending in a square lobe between IV coxæ, which are separated by a diameter; mandibles with three equal teeth on superior margin of fang groove, I femur with row of stiff bristles from coriaceous pits, patella much swollen on upper side, tibia bent and dilate near apical end with an irregular mass of dark hairs and a fringe of long, colorless hairs, metatarsus with two rows of short, stiff bristles which continues on the tarsus; eyes subequal with laterals almost touching.

Palpus; femur much enlarged, the granulations less numerous than in *Gonatium rubens*, patella longer than tibia, superior apophysis of tibia long, slender and curving, almost reaching the tip of the tarsus; below are two apophyses, short and black, the lower one quite complicated; palpal organ fills the cavity and very complicated.

♀ 3.2 mm. long; ceph. 1.5 mm.; abd. 2.2 mm.

Cephalothorax brown, darker than the male, abdomen brownish gray; legs brown, about the same color as the cephalothorax with many hairs but not in rows as in the male; sternum brown; head not high as in the male, but slightly elevated and the eyes a little more separated.

Epigynum a large dark cavity, twice as wide as high with the openings widely separated.

Holotype (♂) Colo.; Long Lake, 28 August, T. D. A. Cockerell; N. Banks Coll.

Allotype (♀) Colo.; Long Lake, 28 August.

Paratype 1 ♂ Colo.; Boulder, Peaceful Valley, 8,000 ft., August, T. D. A. Cockerell; N. Banks Coll.

This species is less brightly colored than *Gonatium rubens* (Blackw.), the European species found in the east, and differs from it in the male palpus and the epigynum in the female. The long, curved apophysis on the tibia of the male palpus is longer and more slender and the other apophyses are more complicated; the epigynum of *Gonatium rubens* is higher than wide and the cavity is much smaller.

Dipœna lineatipes spec. nov.

Plate 1, fig. 7

♀ 1.4 mm. long.

Cephalothorax yellow, black in eye area and a dark triangle from the posterior eyes to the cephalic groove; abdomen round, gray and covered with short, stiff, curved hairs from distinct coriaceous granulations,

more numerous at base than at apex; two pairs of muscle spots, small but distinct; legs yellow, with rows of hairs on tibia and metatarsus longer than the diameter of the joint and a broad dark stripe on tibiae and metatarsi, more distinct on I and II legs; sternum and coxæ yellow; venter gray with stiff hairs, smaller than on the dorsum; eyes, anterior row straight, A.M.E. separated by more than a diameter, about twice as large as A.L.E. and separated from them by a radius; posterior row procurved, equidistant, P.M.E. slightly larger than P.L.E. and a little smaller than A.M.E.; lateral eyes touching; clypeus about twice as high as quadrangle of eyes.

Epigynum rather large for the size of the spider, showing two large circular cavities partly separated by a septum and a pair of small dark dots close together near the epigastric fold.

Holotype (♀) Fla.; Royal Palm Park, 15–24 March, 1930, W. S. Blatchley.

The small size, striped legs and large epigynum are distinct from any described species.

Epeiridae

The American species of Pachygnatha have been in a confused state for many years. In 1845 C. Koch described two species from Pennsylvania, *P. tristriata* and *P. xanthostoma*. These are now in the Berlin Museum. In 1882 Keyserling redescribed a male and female from Boston, Massachusetts, in the Simon Collection as *P. tristriata*. A year later he decided that it was a new species and called it *brevis* and a species found "at Long Island, Philadelphia, and Columbus, (Texas)" in the Marx Collection was called *P. tristriata*. In the same paper he redescribed and figured *P. xanthostoma* from Philadelphia but he evidently did not feel quite sure of his identification for he queried it. Later McCook in American Spiders, 1893, **2**, p. 269, pl. 26, figs. 7, 8 also described *P. xanthostoma* and in a footnote calls attention to the fact that his specimens do not agree in size with that of the original description. He has also added to the confusion by exchanging the figures of the mandibles of *P. xanthostoma* and *P. dorothea* McCook. The latter, he states, has a tooth on the fang and the artist shows a tooth on the upper side of the mandible above the insertion of the fang.

In 1912, Mr. Banks examined the Koch types at the Berlin Museum and found that the species labelled *P. xanthostoma* is what has been recognized as *P. brevis*. Koch compares his species to the European species *P. degeeri* which also has a short abdomen (but little longer than

the cephalothorax) and mandibles at least half as long as the cephalothorax. It also is the most common species in the eastern United States.

Among the many specimens of *P. xanthostoma* Koch (*brevis* Keys.) were several males that differ in the arrangement of teeth on the superior margin of the mandible and the slender tarsal appendage of the palpus. These have been recognized as *P. furcillata* Keys., a species that has been placed as a synonym of *P. xanthostoma* Koch (*brevis* Keys.).

P. dorothea McCook is easily recognized by the tooth on the upper side of the mandible above the insertion of the fang. The type of the genus, *P. clerckii* Sund. also has this tooth, but the three European species differ from the American by the quadrangle of median eyes, which in the European is narrower in front and the P.M.E. always the largest of the eight.

Pachygnatha dorothea McCook

Plate 4, figs. 37, 41

American Spiders, 1893, **3**, p. 270, pl. 26, figs. 3, 4.

♂ 3.2 mm. long.

Cephalothorax brown with a broad marginal stripe and a median stripe in front of thoracic groove; folium dull brown with irregular clear white paired marks, sides and venter pale brown; legs pale yellow; eyes, anterior row recurved, A.M.E. carried forward and nearer each other than to A.L.E., posterior row slightly procurved, P.M.E. nearer each other than to P.L.E., quadrangle slightly higher than wide, median eyes subequal, and lateral eyes touching; clypeus not as high as quadrangle; mandibles divergent, about one half as long as cephalothorax, superior margin of fang groove with a blunt hook or tooth at base of fang and three equidistant teeth, inferior margin with four subequal and equidistant teeth, fang long and sinuate; head relatively low.

Palpus, femur as long as mandible, tibia a little longer than patella, tarsal appendage with a blunt tip, and the usual widened portion one-third from the base.

♀ 3.5 mm. long.

The female has the same coloring as in the male, but the clypeus is a little higher and about equals height of quadrangle. The mandibles are geniculate, not as divergent as in the male and the blunt tooth above the base of the fang is missing; the teeth on the inferior margin is the same.

The type of this species was found near Philadelphia. In the museum

collection there are specimens from Ithaca, New York; Salineville, Ohio; Boulder, Colorado; and Manitoba, Canada. Because it is a small species it has been confused with *P. autumnalis*.

Pachygnatha furcillata Keyserling

Plate 4, figs. 38, 39

Verh. z. b. Ges. Wien, 1883, **33**, p. 662, pl. 21, fig. 11.

♂ 4.8 mm. long; ceph. 2 mm., abd. 3 mm.

Cephalothorax reddish brown; abdomen brown folium covering two-thirds the width of abdomen, sides golden; legs light brown; mandibles, superior margin of fang groove one large hooked tooth near insertion of fang and two smaller teeth close together near median edge; inferior margin, two small teeth about opposite the two teeth on superior margin, fang long and overlapping; eyes, anterior row recurved, A.M.E. about a diameter apart and slightly larger than P.M.E.; posterior row straight; lateral eyes touching; quadrangle of median eyes about square.

Palpus; tibia and patella about equal length, bulb of palpal organ large, not divided, tarsus extending but short distance beyond, tarsal appendage slender, with slender curved tip, with the usual widened portion one-third from tip.

♀ 5.8 mm. long; ceph. 2.5 mm., abd. 3.5 mm.

The colors and position of the eyes are the same as in the male. The mandibles are as Keyserling describes, an even convex margin when seen from the side, not suddenly geniculate as in *P. xanthostoma* (*brevis* Keys.). On the superior margin of the mandible are three small teeth corresponding to those in the male; the inferior margin also has three teeth opposite those on the superior margin.

Allotype (♂); New York, Sea Cliff, N. Banks Coll.

♂ ♀ N. Y.; Ithaca; D. C.; Washington.

Pachygnatha males

1. Eyes of posterior row equidistant; superior margin of mandibles with two large sharp teeth near median edge; tarsal appendage of palpus long and slender; a small species..*autumnalis*

   Eyes of posterior row not equidistant..................................2

2. Mandibles with tooth above insertion of fang; superior margin with three teeth on median half; fang sinuate, with tooth about middle on inner edge; tarsal appendage of palpus with truncate tip; a small species, *dorothea*

   Mandibles without tooth above insertion of fang.....................3

3. Fang with tooth about middle on inner edge; superior margin of mandible with a large tooth opposite tooth of fang and two small teeth near median edge; bulb of palpus about half length of tarsus. . . . . .*tristriata*
   Fang without tooth on inner edge 4
4. Superior margin of mandible with three equidistant teeth, the basal largest; tarsal appendage of palpus broad and spatulate *xanthostoma* (*brevis*)
   Superior margin of mandible with three teeth, basal one large and sharp and two very small ones near median edge; apical half of tarsal appendage very slender, ending in a sharp point. . . . .*furcillata*

Gasteracantha cancriformis (Linné)

Vibradellus carolinus Chamberlin, Bull. Mus. Comp. Zoöl., 1925, **67**, p. 214.

An examination of the type of *Vibradellus carolinus* shows that it is a male *Gasteracantha cancriformis.* Unfortunately the specimen is faded and broken and the fourth pair of legs are missing so that the presence or absence of the comb characteristic of the *Theridiidae* can not be verified. In the description Mr. Chamberlin fails to mention the row of sigillae on the basal margin of the abdomen, but calls attention to "a rounded shoulder or protuberance a little behind each anterolateral cornor" which is all that remains in the male of the large anterolateral spines in the female. The arrangement of eyes is characteristic of many males in the *Epeiridae.*

THOMISIDAE

Xysticus banksi nom. nov.

Xysticus pallidus Bryant, Psyche, 1930, **37**, p. 138, figs. 11, 12, 14, preoccupied by Cockerell, Ent. Month. Mag.; 1890, p. 191.

Xysticus laticeps spec. nov.

Plate 3, fig. 25

♀ 6.5 mm. long; ceph. 3 mm. long, 3 mm. wide, head 2.5 mm. wide; abd. 3.8 mm. long.

Cephalothorax longer than I femur.

Cephalothorax light brown, with a wide marginal dark stripe and dark stripes from lateral eyes converging and ending in a pair of large dark spots above the abdomen; usual dark spot at end of thoracic groove small; abdomen brown with irregular cream color marks and paired dark spots; abdominal spines heavy; sternum light with irregu-

lar dark spots; coxæ light with two dark dots; legs light brown with faint lines of a darker brown; IV femur and tibia with a pair of dark spots at tip; spines, I tibia, 7–5, no lateral, metatarsus, 6–5, 2 lateral.

Epigynum a simple cavity with a narrow septum at base.

Holotype (♀) Ala.; Mobile, 2 August, 1930, W. S. Creighton.

This species belongs near *Xysticus luctans* Koch but differs as follows: head broader, dark stripes on cephalothorax converging, not parallel, greater number of spines on I tibia and the shape of the epigynum It differs from *Xysticus graminis* Emerton by the greater size, the converging dark stripes, much longer legs and the more numerous spines and the epigynum which is broader than long.

Xysticus trimaculatus spec. nov.

Plate 2, figs. 12, 13

♂ 4.5 mm. long; ceph. 2.5 mm., abd. 2.2 mm.

Cephalothorax shorter than I femur.

Cephalothorax golden brown with three subequal dark brown spots on posterior part, a white band between eye rows and a pair of white converging lines from posterior eye row to median dark spot, sides lightly veined with dark; long dark bristles at edge of clypeus, a pair of long bristles above each palpus and a row of smaller bristles outside the white line; abdomen white with many long dark bristles, one median dark spot at basal half followed by four pairs of irregular dark spots; sternum and coxæ light yellow; venter light; legs; I left leg missing, little lighter than cephalothorax, dark ring at tips of I and II tibiae, I and II metatarsi darker and a dark stripe beneath an apical half and a fringe of long white hairs on under side, longer than spines; III and IV legs with dark spots at tip of femora and tibiae; spines; I femur, a row of 6 long spines on upper edge, 5 shorter spines in front, many short dark hairs; I tibia 4–4, 3 lateral, metatarsus, 3–3, 2 lateral, all femora have a row of long dark spines on upper edge that are very conspicuous.

Palpus; tibia shorter than patella, superior apophysis rather small, inferior apophysis with an upper lobe extending towards the palpal organ and a semicircular lobe with a distinct keel at right angles to the tibia, three long bristles on inner edge of tibia; tutaculum small, usual apophyses in center of palpal organ simple and widely separated.

Holotype (♂) Ark.; Hope, 9 June 1931. Miss L. Knobel Coll.

This is closely related to the light form of *Xysticus triguttatus* but differs in the following points; the much larger size, the comparative length the first femur and the cephalothorax, the lighter color cephalo-

thorax and the light legs with a dark line beneath first and second metatarsi, and in the palpus by the different shaped inferior apophysis of the tibia and in the palpal organ by the widely separated central apophyses.

XYSTICUS VARIABILIS Keyserling

Plate 2, fig. 11; Plate 3, fig. 31

Die Spinnen Amerikas, Laterigradae, 1880, p. 40, pl. 1, fig. 19.

♀ 3 mm. long; ceph. 1.5 mm.; abd. 1.8 mm.

Cephalothorax longer than I femur.

Cephalothorax light brown with a median area blotched with cream color, sides darkened with irregular dark veins and a pair of large dark spots in front of the abdomen, usual dark spot at end of thoracic groove small; abdomen with a pair of dark spots at base and three or four dark transverse bars, broken by a median cream color branching figure; sternum and venter light with scattered dark marks; coxæ and under side of legs light; legs light brown with cream color blotches, IV leg dark bands at tips of femur, patella and middle and tip of tibia; spines, I tibia, 4–3, no lateral, metatarsus, 3–3, all longer than diameter of joint, 1 lateral, at the edge of clypeus are several long bristles equal in length to space between A.M.E. and in eye area several long clavate bristles; abdomen with many small clavate bristles from coriaceous pits.

Epigynum an oval depression, wider than high, with a dark median piece and two dark spots below as figured.

The specimen agrees fairly well with Keyserling's description but is a little smaller. The clavate bristles in the eye area and on the abdomen are not mentioned.

♂ 3 mm. long; ceph. 1.7 mm., abd. 1.5 mm.

Cephalothorax longer than I femur.

Cephalothorax brown with a faint V shaped light mark ending at the thoracic groove, median line broken into five dark dashes ending with a rather small dark spot at thoracic groove, sides brown, veined with a darker brown and a pair of large dark spots just in front of the abdomen, very few bristles on cephalothorax; abdomen lighter brown with a pair of dark blotches at base and three broken dark bands across posterior half with parallel cream color lines above and irregular cream color lines on sides, bristles rather large; venter and under sides of legs light; legs light brown, I and II femora with dark spots, tibiae with indistinct dark band at base; III and IV legs dark bands at tips of all

joints; spines, I femur, 4 rather short on front side, 3 on upper edge, tibia 4–4, 2 middle pairs long, 3 lateral; metatarsus 3–3, 2 lateral, first and second pairs very long.

Palpus; superior apophysis of tibia large, inferior apophysis long, ending in a curved knob that rests on the palpus; tutaculum large and curving on the lower side of the palpus; palpal organ with the usual two apophyses which do not stand upright but are turned over and somewhat appressed to palpal organ, subequal with the superior somewhat sinuous; style ending in a circular loop with tip outside the palpus.

Allotype (♂) N. C.; Wilmington, May 1900, J. H. Emerton Coll.

1 ♀ N. C.; Newbern, May 1900; 1 ♂ S. C.; Charleston, May 1900; J. H. Emerton Coll.

This species was described from a female in the Simon Collection. Mr. Banks, after seeing the type, states in Proc. Phila. Acad., 1913, p. 179, "One female, a small species, which resembles a young *stomachosus*." While the males were not found with the female, the size and markings make it quite certain that the two belong together and the male palpus shows that it is a distinct species.

Philodromus bilineatus spec. nov.

Plate 2, figs. 14, 19; Plate 3, fig. 29

♀ 4 mm. long; ceph. 1.5 mm., abd. 2.5 mm.

Cephalothorax light brown with broad dark stripes extending from the P.L.E. to posterior edge of cephalothorax; a faint light lateral stripe; abdomen light brown with the dark stripes on the cephalothorax continued and converging at the apex, sides cream white; sternum, labium and venter almost white; legs light brown with anterior and posterior dark stripes on femora, patellae and tibiae of all legs but most distinct on the III and IV. II leg longest; spines I, tibia, 2–3, 1 lateral, metatarsus, 2–2, II tibia, 2–2–2–2, metatarsus, 2–2, 2 lateral; eyes, black surrounded by white rings; anterior row recurved, subequal, A.M.E. nearer A.L.E. than to each other; posterior row recurved, P.M.E. smallest of the eight and widely separated; quadrangle of median eyes much wider than high and once and a half wider behind than in front; lateral eyes on separate tubercles at the extreme edge of the carapace; clypeus more than twice the diameter of anterior eye with a few long bristles; cephalothorax longer than wide with sides almost parallel; abdomen notched at base.

Epigynum with a broad median lobe with two dark bodies each side as figured.

♂ 2.8 mm. long.

Markings the same as on the female but less distinct and the stripes on the anterior legs reduced to rows of elongated dots.

Palpus; tibia but little longer than patella with a stout, curved black hook which rests against tarsus, and an inferior, flat leaf-like lobe extending over the palpal organ. Palpal organ about filling tarsal cavity; the style is short and black and the tips rest against a transparent lobe in the upper part of the organ; loop is almost vertical.

Holotype (♂) Fla.; Dunedin, March 1927, W. S. Blatchley Coll.

Allotype (♀) Fla.; Dunedin, March 1927.

Paratype ♀ Fla.; Royal Palm Park, March 1927.

This species differs from *Philodromoides pratariae* Scheffer in the few spines under the anterior tibiae, but it agrees with it in the position of the lateral eyes on the extreme edge of the carapace. It agrees with *Philodromus montanus* spec. nov. in the general shape of the palpus, the two dark lines on the under side of the legs, but differs from it, by the arrangement of the eyes and the parallel sides of the carapace and the narrow and less sloping clypeus.

PHILODROMUS MONTANUS spec. nov.

Plate 2, fig. 20; Plate 3, fig. 26

♀ 4 mm. long; ceph. 1.5 mm., abd. 2.5 mm.

Cephalothorax with broad pale median stripe, sides darker with a narrow marginal light line; abdomen light, with vague transverse bands on apical half, sides darker; sternum light with a few dark dots about margin; venter light; legs, I missing, light with a dark line on anterior and posterior sides of femora, patellae and tibiae; spines II, tibia, 2–2–2, 2 lateral, metatarsus, 2–2, 2 lateral; eyes, anterior row recurved, A.M.E. slightly nearer A.L.E. than to each other; posterior row of eyes recurved, subequal, P.M.E. twice as far from each other as from P.L.E.; clypeus sloping and equal to space between A.M.E.

Epigynum, median lobe narrow at base with oval cavity each side as figured.

♂ 3 mm. long; ceph. 1.5 mm., abd. 1.6 mm.

Cephalothorax brown, mottled with a darker shade and a little lighter in center; abdomen brown without any definite markings, but mottled with a darker brown; sternum and venter pale yellow; legs light brown, almost yellow, with a dark line on anterior and posterior sides of femora, patellae, tibiae and metatarsi; spines, I tibia, 2–2–2,

2 lateral, metatarsus, 2–2, 3 lateral; eyes same as in female but clypeus is higher and more sloping.

Palpus short, tibia shorter than patella, and tibia and patella not as long as tarsus; tibia with a short black hook on the superior side and a thin transparent leaf-like inferior apophysis which rests against the palpal organ; tarsal cavity almost filled with palpal organ, style starts above the middle and has a straight black tip which rests against a transparent lobe; the loop is oblique.

Holotype (♂) N. C.; Black Mt.; North Fork Swannanoa River, 18–30 May, N. Banks Coll.

Allotype (♀) N. C.; Black Mt.

This pair was identified as *Philodromus rufus* Walckenaer by Mr. Banks in his list of spiders from North Carolina. It belongs to the group of *Philodromus* with the P.M.E. widely separated and with dark lines on the legs, *minutus* Banks, *inaequipes* Banks, and *carolinus* Banks. It differs from *minutus* in the male palpus by the greater length of the inferior apophysis and the longer embolus, and from *inaequipes* by the narrower palpus and the shorter superior apophysis.

PHILODROMUS INAEQUIPES Banks

Plate 2, fig. 21; Plate 3, fig. 33

Can. Ent., 1900, **32**, p. 99.

♂ 3 mm. long; II femur 2.3 mm. long.

Cephalothorax dark brown, with a very faint light V shaped mark over thoracic groove; abdomen dark brown with a broad median stripe of a darker brown; sternum, coxæ and under side of legs light brown; venter white; legs light brown, I pair missing, a dark line on anterior and posterior sides of II femur, and anterior side of III and IV femora and tibiae; eyes, anterior row recurved, subequal, A.M.E. slightly nearer A.L.E. than to each other; posterior row recurved, P.M.E. separated by nearly twice the space between A.M.E.

Palpus; patella and tibia about equal length, tibia as broad as long, the superior apophysis a black hook curved towards the palpus, equal in length to more than half the diameter of the joint; inferior apophysis a flattened white lobe which rests against the palpal organ; palpal organ fills the tarsal cavity; style short, starts about the middle and extends obliquely across the cavity; loop is broad and is parallel to embolus.

Allotype (♂) Va.; Falls Church, N. Banks Coll.

1 ♀ Va.; Falls Church, N. Banks Coll.

This species was described from a single female from Washington, D. C. Among the unidentified material in the museum, a male and female from Falls Church are this species. It belongs to the section of Philodromus with widely separated P.M.E. and dark lines on the sides of the legs.

Philodromus emertoni spec. nov.

Plate 2, figs. 17, 22; Plate 3, fig. 34

♂ 3.5 mm. long; ceph. 1.5 mm.

Cephalothorax light brown, without median light stripe but with scattered dark spots on clypeus, around eyes and about dorsal groove; abdomen brown, without markings and covered with iridescent hairs; sternum light with dark spots about margin; coxæ, venter and under side of legs light; legs light brown with scattered dark dots on all joints, II leg much longer than I leg; spines I femur, 3 on upper side, 3 basal, tibia, 2–2–2, 3 lateral, all longer than diameter of the joint, but slender and colorless, metatarsus, 2–2–2; scopula thin; cephalothorax as long as wide; eyes, anterior row recurved, subequal and equidistant; posterior row almost straight, P.M.E. separated by more than twice the distance between P.L.E. and P.M.E.

Palpus rather short; tibia not as long as patella, superior apophysis short, acutely pointed with a small tooth on exterior side, inferior apophysis very close to superior, slender, thin and folded, extending on the upper side of the tarsus, so that in the ventral view only the tip is seen a little above the origin of the style; palpal organ fills the tarsal cavity, style starts on the exterior edge, extends across the middle of the upper part, making about two-thirds of a circle; the usual loop is almost horizontal. The small black spine sometimes found in the upper half just under the tip of the embolus is wanting.

♀ 4.5 mm. long; ceph. 1.8 mm.

Cephalothorax cream color with vague darker marks and dark dots on clypeus, about eyes and thoracic groove as in male; abdomen covered with small dark dots, but with a broad median lighter area which has four pairs of dark spots; sternum cream color with many dark dots about margin; coxæ and venter light; legs light with many dark dots on all joints; spines as in male but longer and heavier; cephalothorax longer than wide; eyes as in male.

Epigynum has a broad median septum with a wide oval area each side.

Holotype (♂) N. C.; Newbern, May 1900, J. H. Emerton Coll.

Allotype (♀) N. C.; Newbern, May 1900, J. H. Emerton Coll.

This species is similar to *Philodromus ornatus* Banks but the palpus is twice as large and much broader in proportion, the inferior apophysis is narrower and closer to the superior and the loop is nearer horizontal. The palpal organ is very similar to *Philodromus robustus* Emerton, but both superior and inferior apophysis are different and the legs of *Philodromus robustus* are very hairy.

Philodromus aureolus (Clerck)

Araneus aureolus Clerck, Svensk. Spindl., 1757, p. 133, pl. 6, fig. 9.
Philodromus canadensis Emerton, Can. Ent., 1917, **49**, p. 270, fig. 22.

Keyserling in Die Spinnen Amerikas, Laterigradae, 1880, states that this species has a wide distribution over the western states. On examining the type of *Philodromus canadensis* it proves to be the European species. It is common throughout Canada and as far south as Boston, Massachusetts, and Ithaca, New York. It is possible that *Philodromus californicus* Keyserling may be this species.

Philodromus infuscatus Keyserling

Fig. 28

Philodromus infuscatus Keyserling, Die Spinnen Amerikas, Laterigradae, 1880, **1**, p. 222, pl. 5, fig. 122,.
Philodromus unicolor Banks, Proc. Phil. Acad., 1892, p. 61, pl. 3, fig. 22.
Philodromus macrotarsus Emerton, Can. Ent., 1917, **49**, p. 271, fig. 22, nos. 1, 2.

This species was described by Keyserling from a female from Baltimore and by Mr. Banks from a female from Ithaca. Mr. Emerton described the male from Vineland, Ontario. The male has been found since with females from Falls Church, Virginia, and from Poughkeepsie, New York. Mr. Emerton has an excellent figure of the male palpus.

Philodromus laticeps Keyserling

Philodromus laticeps Keyserling, Die Spinnen Amerikas, Laterigradae, 1880, p. 215, pl. 5, fig. 118.
Philodromus louisianus Chamberlin, Proc. U. S. Nat. Mus., 1924, **63**, p. 23, pl. 5, fig. 39.

The type of *Philodromus louisianus* Chamberlin proves to be *Philodromus laticeps* Keyserling, described from Georgia. The male

is not known but the female has been found as far north as Newton, Massachusetts.

Apollophanes texanus Banks

Apollophanes texanus Banks, Jour. N. Y. Ent. Soc., 1904, **12**, p. 113, pl. 5, fig. 12, pl. 6, fig. 20.

Philodromus syntheticus Chamberlin, Proc. Cal. Acad. Sci., 1925, **14**, p. 124, figs. 33, 36.

On examining the type of *Philodromus syntheticus* Chamberlin it is found to be *Apollophanes texanus* Banks. The strongly procurved posterior row of eyes which are equidistant, as well as the A.L.E., P.L.E. and P.M.E. which form an equilateral triangle, are characters of *Apollophanes* rather than *Philodromus*.

Ebo inquisitor (Thorell)

Plate 2, fig. 16; Plate 3, fig. 30

Philodromus inquisitor Thorell, Bull. U. S. Geol. Surv., 1877, **3**, p. 502.

Philodromus thorellii Marx, Catalogue, 1889, p. 558, *thorellii* preoccupied by Cambridge, 1872.

Philodromus inquisitor Emerton, Trans. Conn. Acad., 1894, **9**, p. 419, pl. 5, fig. 8.

♂ 4 mm. long, ceph. 1.6 mm. long, 1.8 mm. wide, abd. 2.4 mm. long. Cephalothorax with median mottled light stripe, sides dark brown; abdomen with spear-shaped dark mark at basal half, sides and apex dark; the contrast in color between basal half and apex not as great as in the female; sternum, coxæ and venter light brown covered with minute brown dots; legs light brown covered with small brown dots which form bands at middle and tips of femora, base and tips of tibiae; I femur 2.5 mm. long, II femur 4.5 mm. long; sternum a little wider than long; II coxæ largest and IV coxæ separated by a diameter; labium about as high as wide; eyes, anterior row recurved so that upper margins are even, A.M.E. largest of the eight, and A.L.E. smallest, A.M.E. separated by a little more than a diameter and from the A.L.E. by about a radius; posterior row straight, subequal, P.M.E. separated by more than three diameters and from P.L.E. by about two diameters; quadrangle widest behind and about as high as wide between P.M.E.; clypeus vertical as high as quadrangle.

Palpus, femur longer than cephalothorax, tibia longer than patella, tibia and patella not as long as femur, superior apophysis short, trun-

cate with distinct tooth at each corner as figured; inferior apophysis semitransparent, broad and a little shorter than superior; tarsus long and narrow, palpal organ filling cavity, style starts at upper third of organ and follows curve of cavity making a small semi-circle; loop small and horizontal.

Allotype (♂) Cal.; Claremont, C. F. Baker, N. Banks Coll., many females from Colorado and Washington.

By the characters used in separating genera, this species would be placed in *Ebo* rather than *Philodromus*. The large anterior median eyes, the posterior row of eyes almost straight and the second leg much longer than the first are all characters of *Ebo*, but the general appearance is not much like the type of the genus. Mr. Emerton states that he has seen the type of *Philodromus inquisitor* in the Packard Collections and gives an excellent figure of a female from Laggan, Canada, which is now in the museum collection. He did not note the large anterior median eyes or the greater length of the second leg.

Ebo cockerelli spec. nov.

Plate 2, figs. 15, 18; Plate 3, figs. 27, 36

♂ 3.5 mm. long; ceph. 1.5 mm. long, 1.6 mm. wide; abd. 2.5 mm. long.

Cephalothorax light brown with a light V shaped mark ending at the thoracic groove; sides with dark veins; abdomen with a spear shaped dark mark at the basal third and indistinct chevrons formed by dark dots on apical half; sternum and coxæ light brown with many dark dots; venter almost white; legs light yellow with dark bands formed by dots at tips of femora and base and tips of tibiae; spines small and inconspicuous; spines, I tibia, 2–2, 2 lateral, metatarsus, 2–2, 1 lateral; thin scopula on I metatarsus and tarsus and on II, III and IV tarsi; II pair of legs much the longest, II femur twice as long as I femur; sternum one-third wider than long and widest between second coxæ; labium about as high as wide at the base; IV coxæ separated by a diameter and II coxæ slightly longest; eyes, anterior row slightly recurved, A.M.E. largest of the eight, separated by more than a diameter, A.L.E. about a radius from A.M.E. and about half as large as A.M.E.; posterior row slightly procurved, subequal, P.M.E. nearer P.L.E. than to each other; quadrangle not quite as high as space between P.M.E.; clypeus vertical about equal to height of quadrangle.

Palpus longer than cephalothorax; tibia nearly twice as long as patella and longer than tarsus; superior apophysis of tibia a short

truncate lobe with three apical teeth; inferior apophysis a white leaf-like lobe folded against superior apophysis; palpal organ very simple; style starts in upper third and follows contour of the cavity, ending about opposite to its origin; loop oblique; the usual dark spine found in *Philodromus aureolus* missing.

♀ 4 mm. long; ceph. 1.6 mm. long, 1.7 mm. wide; abd. 2.5mm. long. The colors and markings are the same as in the male but the chevrons at the apex of the abdomen are not as distinct and are more like two converging dark lines; the dark dots on the legs are more scattered and the dark bands less conspicuous; the II pair of legs is much the longest and the II femur is once and a half the length of the I femur; eyes as in male.

Epigynum has a broad septum with two oblique dark lines on each side.

Holotype (♂) New Mexico; Mesilla Park, T. D. A. Cockerell; N. Banks Coll.

Allotype (♀) New Mexico; Mesilla Park.

Paratype (♀) Col.; Boulder, T. D. A. Cockerell.

This species differs from *Ebo inquisitor* (Thorell) in the male palpus and the epigynum. They both have Philodromus markings, but agree with the characters used to separate *Ebo* from *Philodromus*.

Ebo oblongus Simon

Plate 3, fig. 23

Ann. Soc. Ent. Belgique, 1895, **39**, p. 442.

♀ 6.3 mm. long; ceph. 2.5 mm. long, 2.5 mm. wide, abd. 3.8 mm. long.

Cephalothorax with median light stripe, sides mottled with a dark brown; abdomen light with median dark lanceolate mark on basal half followed by faint chevrons and irregular dark marks on sides of posterior half; legs light yellow, lighter than the cephalothorax with darker spots at base of spines and many minute dots forming broken bands at middle and tips of femora and over the entire length of tibiae; sternum and venter light yellow covered with minute dark dots; coxæ yellow with few dots; clypeus almost vertical and as high as quadrangle of median eyes; labium wider than high; coxæ subequal; sternum longer than wide, widest between second coxæ and prolonged in a blunt point between fourth coxæ; fourth coxæ separated by almost a diameter; eyes, anterior row recurved, A.M.E. largest of the eight and separated

by a diameter and a half, and by half a diameter from A.L.E.; posterior row but little longer than anterior, only slightly recurved, eyes subequal, P.M.E. slightly nearer P.L.E. than to each other; quadrangle as high as distance between P.M.E.; A.L.E., P.M.E. and P.L.E. form an equilateral triangle; left legs missing, II leg longer than I; II femur one-fifth longer than I; spines, I and II tibiae, 2–2–2, 3 lateral, metatarsi, 2–2–2, longer than diameter of joint, 3 lateral.

Epigynum openings are a pair of transverse slits in a semicircular light area, above two pairs of round dark spots as figured.

1 ♀ Ala.; Auburn, C. F. Baker, N. Banks Coll.

Simon described this species from specimens about half grown. A co-type given by him to Mr. Banks is now in the museum collection. The adult specimen has been with the unidentified *Philodromus*. It agrees with *Ebo latithorax* Keyserling in the large A.M.E., the short and nearly straight posterior row of eyes and the vertical clypeus, but it differs in the spiny legs and the second pair of legs which are longer than the first but are not greatly elongated, and the cephalothorax which is only as wide as long.

Tibellus maritimus (Menge)

Plate 3, fig. 35; Plate 4, fig. 46

Thanatus maritimus Menge, Preussische Spinnen, 1874, p. 398, pl. 225.
Tibellus oblongus Simon, Arachn. France, 1875, **2**, p. 311, pl. 8, fig. 12.
Tibellus maritimus Kulczynski, Mem. Acad. Imp. Sci. St. Petersburg, 1908 (8), **18**, p. 69–70.

♀ 7.3 mm. long; ceph. 2.5 mm., abd. 5 mm.

Cephalothorax pale yellowish brown, a broad median dark stripe with many short stiff hairs directed forwards, scattered short hairs directed forwards on the sides; abdomen bifid at base, pale brown with a narrow median dark stripe without pair of dark spots near apex; sternum, mouth parts and coxæ pale yellow with dark hairs directed forward, venter pale brown; legs pale yellow, IV leg longest and much longer than III leg, scopulate on entire length of tarsi and metatarsi; labium longer than wide; sternum longer than wide in proportion of 5 to 4; IV coxæ almost touching; eyes, anterior row recurved, subequal and equidistant, posterior row very strongly recurved, P.M.E. slightly smaller than P.L.E. and closer to each other than to P.L.E., quadrangle of median eyes slightly higher than width between A.M.E.; clypeus about as high as quadrangle and almost vertical.

Epigynum with a narrow median septum as figured.

♀ Alaska; Fox, 13 June 1931, Dr. G. Tullock.

♀ Wash.; Friday Harbor, 5 July 1927, L. G. Worley.

It is very probable that this species is distributed across the northern part of America. Kulczynski states that from the figure by Emerton in Hentz, Spiders of North America, pl. 20, fig. 11, probably *T. maritimus,* not *T. duttonii* which is supposed to be *T. oblongus,* is figured. It is not surprising that the two species have been confused in America as European authors have not always distinguished between them. According to de Lessert in Catalogue des Invertebres de la Suisse, 1910, *T. oblongus* always has a pair of dark spots near the tip of the abdomen in both sexes, which is wanting in *T. maritimus.*

CLUBIONIDAE

Myrmecotypus cubanus Banks

Plate 4, figs. 43, 45

Trans. Ent. Soc. London, 1926, **24**, p. 433, fig. 1.

♀ 4 mm. long; ceph. 1.8 mm.; abd. 2 mm.

Cephalothorax brown, a little paler about eye area; abdomen brown with scattered white flattened hairs; sternum, mouth parts and I coxæ brown, II, III and IV coxæ and trochanters white, venter brown with white hairs on sides; legs slender, I and II femora light brown, patellae, tibiae and metatarsi lighter, with dark lateral stripes, III and IV brown, femora with white hairs; spines, 2 long spines near apex of femora, I tibia, 2–2, metatarsus, 2–2; eyes; anterior row straight, A.M.E. largest of eight, a little more than a diameter apart and about a radius from A.L.E.; posterior row but little longer than anterior, straight and subequal, P.M.E. separated by about three diameters and from P.L.E. by at least two diameters; quadrangle almost square; clypeus with scattered long, white hairs about as high as quadrangle. Cephalothorax with a broad head, moderately high, widest between II and III legs, cephalic groove very short; abdomen with a scutum covering more than basal two-thirds, widest at end of scutum; large corneous plate on basal third of venter.

Epigynum very simple, two oval openings widely separated.

1 ♀ Texas; Brownsville, C. Scheffer.

The genus *Myrmecotypus* was made by O. P. Cambridge in 1894 for the species *fuliginosus.* Simon in Hist. Nat. Araignees, 1897, 2, p. 175, places the genus as a synonym of *Apochinomma,* Pavesi, F. O. P. Cam-

bridge in Biol. Centr. Amer., 1899, 2, p. 80, after examining a female *Apochinomma* sent him by Simon, shows that the two are distinct genera. Mr. Banks described two species from Panama in 1929, both differing from the three Mexican species.

TRACHELAS BICOLOR Keyserling

Verh. z. b. Ges. Wien, 1887, **37**, p. 440, pl. 6, fig. 15.

The type is in the museum collection and is from Haiti. Mr. W. S. Blatchley found a female at Royal Palm Park, Florida, 24 March 1925. It differs from *Trachelas laticeps* by the eyes and the epigynum. The male is not known.

TRACHELAS LATICEPS spec. nov.

Plate 3, fig. 24

♀ 5 mm.

Cephalothorax brown, rugose with many short hairs; abdomen pale yellow, covered with fine short hairs and scattered long bristles; sternum, labium and maxillae brown with scattered hairs; venter light; legs, I brown, enlarged, II, III and IV pale yellow, no spines but I tibia with a row of small cusps, I metatarsus with two rows of cusps, II metatarsus with one row of cusps, a dense brush of black hairs at tip on ventral side of tibiae III and IV; spur on posterior side of IV patella; III without any cusps on femur, patella or tibia; eyes, anterior row straight, subequal, A.M.E. separated by less than a diameter and as far from P.M.E., more than a diameter from A.L.E.; posterior row recurved and much longer than anterior row, P.M.E. about two diameters apart; clypeus not as high as diameter of A.M.E.; mandibles large and swollen, two teeth on inferior margin of fang groove and three teeth on superior margin.

Epigynum as figured.

Holotype (♀) Fla.; Powelton P. O., Mrs. C. M. Willard.

Co-types (♀) Fla.; Royal Palm Park, 7–14 March 1930, C. W. Blatchley; ♀ Fla.; Sebastian, April 1932, G. Nelson.

Trachelas laticeps differs from *T. tranquillus* and *T. bicolor* by the epigynum and the slight differences in eye arrangement. In *T. tranquillus* the openings of the epigynum are large, dark and are separated by less than a radius, and the A.M.E. are the largest; in *T. bicolor* the openings of the epigynum are small, about a diameter apart and the epigastric area is almost twice as high as wide, the eyes of the anterior

row are subequal; in *T. laticeps* the openings are much larger, are separated by almost a diameter and the area is almost twice as wide as high. The males of *T. bicolor* and *T. laticeps* are unknown.

Corinna gracilipes (Keyserling)

Plate 3, fig. 32

Hypsinotus gracilipes, Keyserling, Verh. z. b. Ges. Wien; 1887, **37**, p. 448, pl. 6, fig. 19.

♂ 9 mm. long; ceph. 4.5 mm.

Cephalothorax dark red brown, rugose, with a few long hairs about eyes; abdomen light gray; sternum, maxillae and labium dark brown; venter pale; legs and palpi pale brown; spines, I tibia, 2–2–2–2–2–2, metatarsus, 2–2; II tibia, 5–3, metatarsus, 2–2; eyes, anterior row almost straight, A.M.E. largest, separated by a scant diameter and about a radius from A.L.E.; posterior row a little longer than anterior and slightly procurved, eyes equidistant, P.M.E. smallest of the eight; quadrangle wider than high; clypeus higher than diameter of A.M.E.; mandibles swollen at base, porrect and transversely corrugated, four teeth on inferior margin of fang groove and three teeth on superior margin with a dense scopula of long hairs on the outer side.

Palpus; tibia almost twice as long as patella with many processes near the tip as figured.

Allotype (♂) Fla.; Miami, July 1916.

The type, a female, is from Haiti. This is undoubtedly the male as it agrees with the type in the museum collection in the eye arrangement and the number of spines on the anterior legs.

Pseudosparianthis cubana Banks

Second Rep. Centr. Exper. Sta. Cuba, 1909, p. 165, pl. 45, fig. 4.

Among the spiders collected by Mr. W. S. Blatchley at Royal Palm Park, Florida, is a female of this species. It is the first time that the genus has been found in the United States.

ATTIDAE

Metaphidippus longipalpus Cambridge

Biol. Centr. Amer., 1901, **2**, p. 264, pl. 23, fig. 12.

One male and two females were found by Mr. C. Schaeffer at Brownsville, Texas. The first record of this Central American species in the

United States. The teeth on the mandible and the male palpus are very characteristic.

Icius cinctipes Banks

Plate 4, figs. 42, 47

Can. Ent., 1900, **32**, p. 101.

♀ 2.5 mm. long; ceph. 1 mm.; abd. 1.8 mm.

Cephalothorax black about eyes, covered with short, white hairs, thoracic part brown with a dark margin; abdomen dirty white with dark markings; sides dark, venter infuscate; legs light with dark spots on ventral sides of all joints, forming a broken ring at base of anterior tibiae and metatarsi; sternum light brown without marks; palpi with dark bands on upper side of patella and tibia, two terminal joints slightly enlarged; legs 4, 3, 1, 2, first pair of legs slightly enlarged, patella and tibia of equal length, metatarsus but little shorter than tibia and as long as tarsus; spines, I tibia, 2–2, metatarsus 2–2, longer than diameter of joint and overlapping; posterior legs almost devoid of spines; I coxæ separated by less than their diameter; sternum oval, widest between II coxæ; IV coxæ separated by less than half a diameter; inferior margin of mandible with one tooth; eye area occupying about two-fifths of the cephalothorax; anterior row of eyes recurved so that upper margins are even; third row not quite as wide as cephalothorax and the small eyes nearer the first than the third row.

Epigynum is a pair of simple oblique openings close together, not showing any of the internal structure.

1 ♀ Fla.; Royal Palm Park, March 1930, W. S. Blatchley Coll.

This species was described from females from Baton Rouge, Louisiana. An immature specimen from Punta Gorda, Florida, listed by Mr. Banks as *Habrocestum pulex* (Hentz) is undoubtedly this species. The generic position is uncertain. Most species of Icius are larger and have three pairs of spines beneath the first tibia and the cephalothorax is usually much lower and flatter than in this species, but until a male is found, it is thought best to leave it in the genus *Icius* which harbors many species that do not belong to it.

EXPLANATION OF PLATES

PLATE 1

PLATE 1

Fig. 1. *Euryopis emertoni* Bryant, ventral view of left palpus.
Fig. 2. *Euryopis ornata* Bryant, dorsal view of male.
Fig. 3. *Euryopis ornata* Bryant, ventral view of left palpus.
Fig. 4. *Theridion quadrimaculatum* (Banks), ventral view of left palpus.
Fig. 5. *Gonatium crassipalpus* Bryant, epigynum.
Fig. 6. *Gonatium crassipalpus* Bryant, dorsal view of left palpus.
Fig. 7. *Dipœna lineatipes* Bryant, epigynum.
Fig. 8. *Gonatium crassipalpus* Bryant, lateral view of male cephalothorax.
Fig. 9. *Gonatium crassipalpus* Bryant, lateral view of left palpus.
Fig. 10. *Gonatium crassipalpus* Bryant, first leg of male.

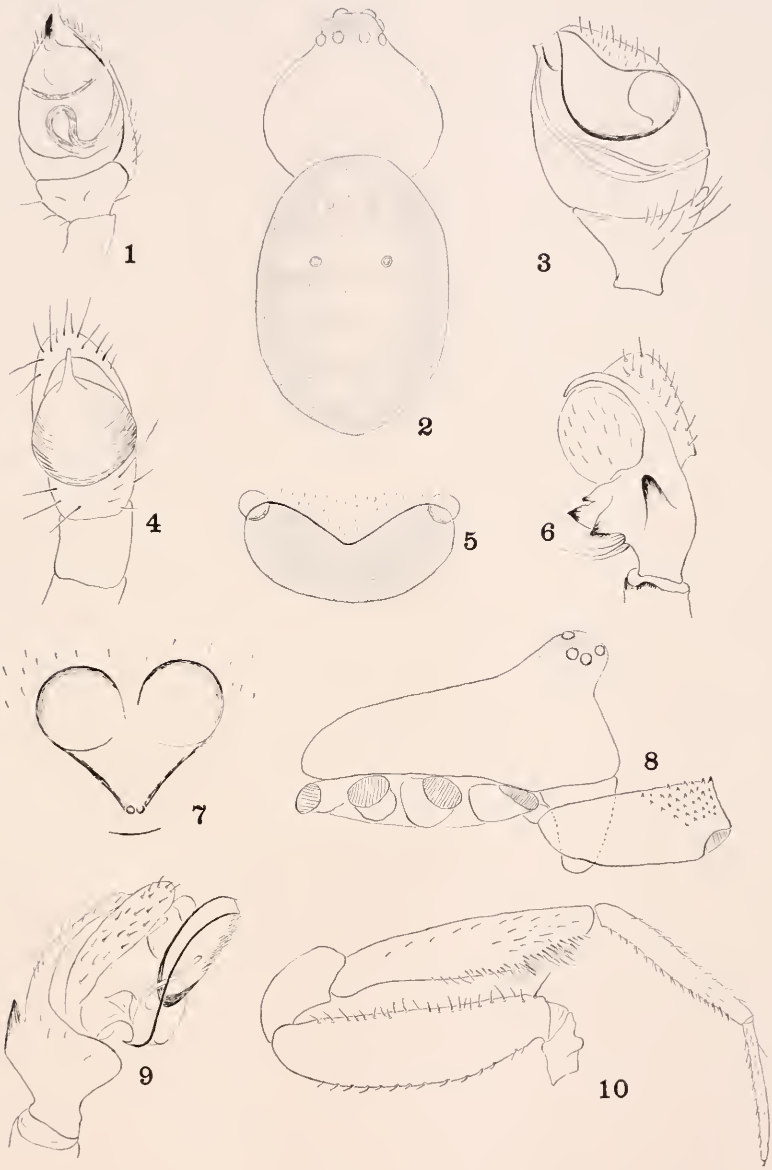
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PLATE 2

PLATE 2

Fig. 11. *Xysticus variabilis* Keys., ventral view of left palpus.
Fig. 12. *Xysticus trimaculatus* Bryant, lateral view of left palpus.
Fig. 13. *Xysticus trimaculatus* Bryant, ventral view of left palpus.
Fig. 14. *Philodromus bilineatus* Bryant, eyes of female.
Fig. 15. *Ebo cockerelli* Bryant, ventral view of left palpus.
Fig. 16. *Ebo inquisitor* (Thorell), tibial apophysis of left palpus.
Fig. 17. *Philodromus emertoni* Bryant, tibial apophysis of left palpus.
Fig. 18. *Ebo cockerelli* Bryant, tibial apophysis of left palpus.
Fig. 19. *Philodromus bilineatus* Bryant, ventral view of left palpus.
Fig. 20. *Philodromus montanus* Bryant, ventral view of left palpus.
Fig. 21. *Philodromus inaequipes* Banks, ventral view of left palpus.
Fig. 22. *Philodromus emertoni* Bryant, ventral view of left palpus.


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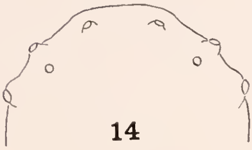
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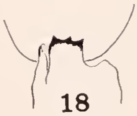
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PLATE 3

PLATE 3

Fig. 23. *Ebo oblongus* Simon, epigynum.
Fig. 24. *Trachelas laticeps* Bryant, epigynum.
Fig. 25. *Xysticus laticeps* Bryant, epigynum.
Fig. 26. *Philodromus montanus* Bryant, epigynum.
Fig. 27. *Ebo cockerelli* Bryant, eyes of male.
Fig. 28. *Philodromus infuscatus* Keys., epigynum.
Fig. 29. *Philodromus bilineatus* Bryant, epigynum.
Fig. 30. *Ebo inquisitor* (Thorell), eyes of male.
Fig. 31. *Xysticus variabilis* Keys., epigynum.
Fig. 32. *Corinna gracilepes* (Keys.), lateral view of tibia of left palpus.
Fig. 33. *Philodromus inaequipes* Banks, epigynum.
Fig. 34. *Philodromus emertoni* Bryant, epigynum.
Fig. 35. *Tibellus maritimus* (Menge), epigynum.
Fig. 36. *Ebo cockerelli* sp. n., epigynum.

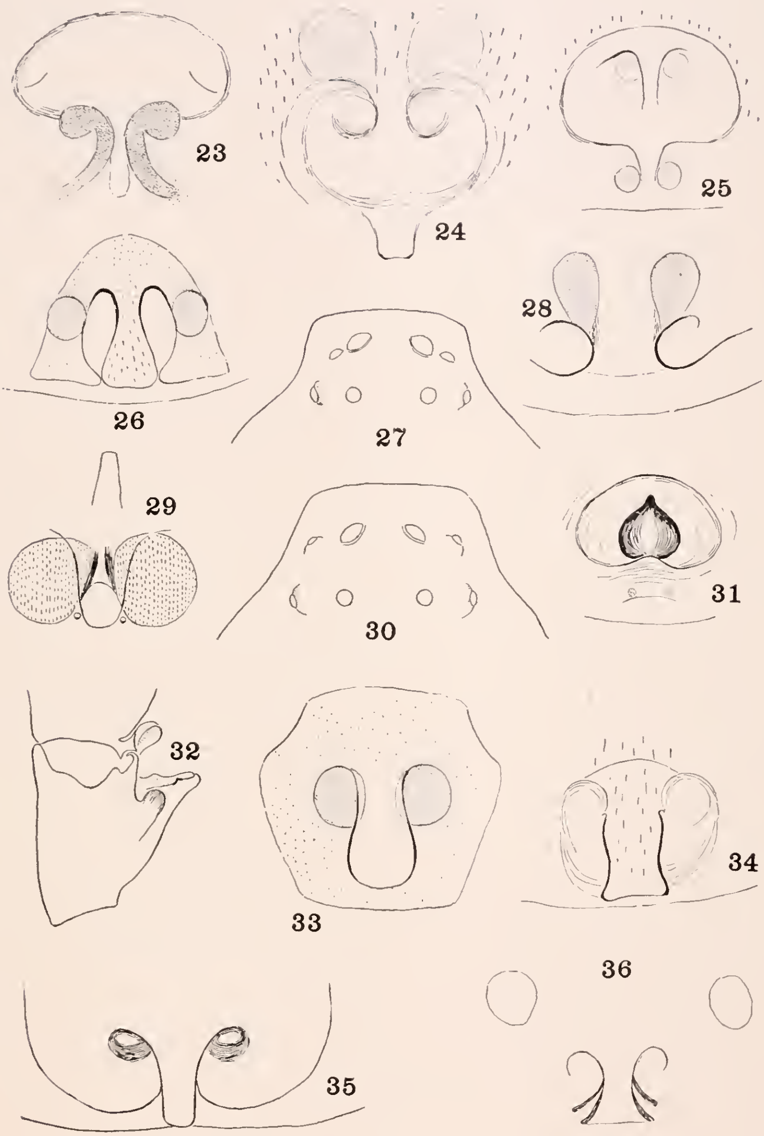
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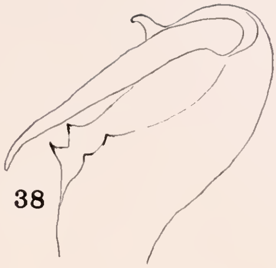
PLATE 4

PLATE 4

Fig. 37. *Pachygnatha dorothea* McCook, lateral view of left palpus.
Fig. 38. *Pachygnatha furcillata* Keys., ventral view of left mandible.
Fig. 39. *Pachygnatha furcillata* Keys., lateral view of left palpus.
Fig. 40. *Pachygnatha autumnalis* Keys., lateral view of left palpus.
Fig. 41. *Pachygnatha dorothea* McCook, ventral view of left mandible.
Fig. 42. *Icius cinctipes* Banks, epigynum.
Fig. 43. *Myrmecotypus cubanus*, Banks, epigynum.
Fig. 44. *Pachygnatha autumnalis* Keys., ventral view of palpus.
Fig. 45. *Myrmecotypus cubanus* Banks, dorsal view of female.
Fig. 46. *Tibellus maritimus* (Menge), lateral view of left palpus.
Fig. 47. *Icius cinctipes* Banks, dorsal view of female.


37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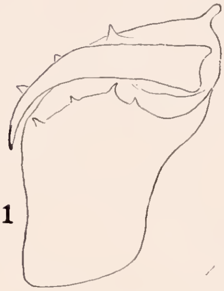
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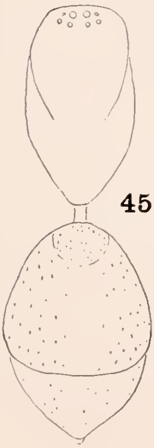
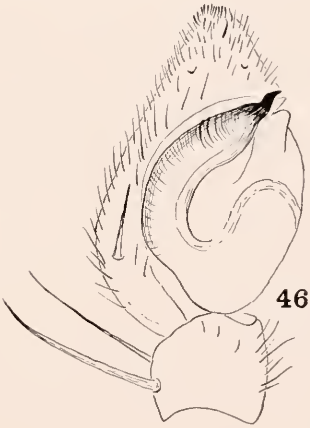
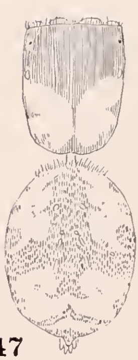
43


44


45


46


47

Bulletin of the Museum of Comparative Zoölogy

AT HARVARD COLLEGE

Vol. LXXIV, No. 7

REPORTS ON THE SCIENTIFIC RESULTS OF AN EXPEDITION TO THE SOUTHWESTERN HIGHLANDS OF TANGANYIKA TERRITORY

VII

HERPETOLOGY

By Arthur Loveridge

With Three Plates

CAMBRIDGE, MASS., U. S. A.

PRINTED FOR THE MUSEUM

October, 1933

PUBLICATIONS

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY

AT HARVARD COLLEGE

There have been published of the BULLETIN Vols. I to LXV, LXVII–LXXIV, of the MEMOIRS Vols. I to LI, LIV.

The BULLETIN and MEMOIRS are devoted to the publication of original work by the Officers of the Museum, of investigations carried on by students and others in the different Laboratories of Natural History, and of work by specialists based upon the Museum Collections and Exploration.

These publications are issued in numbers at irregular intervals. Each number of the Bulletin and of the Memoirs is sold separately. A price list of the publications of the Museum will be sent on application to the Director of the Museum of Comparative Zoölogy, Cambridge, Massachusetts.

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No. 7.— *Reports on the Scientific Results of an Expedition to the Southwestern Highlands of Tanganyika Territory*

VII

Herpetology

By Arthur Loveridge

The material discussed in the following pages was collected by the author with a view to throwing light on the faunal distribution of the southwestern highlands of Tanganyika Territory; this aspect of the collection is dealt with in the introduction to this series of reports where full information will be found as to altitudes and localities. The investigation was undertaken on behalf of the Museum of Comparative Zoölogy and in part financed by a grant from the Carnegie Institute of Washington.

Pt. I. *Reptilia*

MATERIAL

The period of collecting was from November 1, 1929 to July 9, 1930, during which time 2,117 reptiles representing 125 species were preserved. This total comprised 1 species of crocodile, 7 of tortoises and turtles, 54 of snakes, 47 of lizards and 16 kinds of chameleon; in all 30 forms of reptiles were new to the collection of the Museum of Comparative Zoölogy.

One might single out for special mention such rarities as: *Chilorhinophis gerardi, Rhinocalamus dimidiatus* and *Vipera superciliaris* among snakes; *Paragonatodes quattuorseriatus, Chamaesaura miopropus* and *Ablepharus megalurus* among lizards and *Chameleon anchietae, Chamaeleon fülleborni* and *Brookesia platyceps* in the Rhiptoglossa.

Naturally as thorough a study of this material as has been possible involves quite a number of taxonomic alterations. Nor is this remarkable, for in planning the itinerary I arranged to visit the type localities of a dozen species of questionable status with the object of securing adequate series of topotypic specimens so as to elucidate their relationships and range of variation.

SUMMARY OF TAXONOMIC ALTERATIONS

The following new species or races from this collection have already been described briefly; additional information regarding them will be found in the present paper.

Lycophidion capense uzungwensis	Dabaga & Kigogo, Uzungwe Mtns.
Atheris barbouri	Dabaga & Madehani, Ukinga Mtns.
Agama agama turuensis	Unyanganyi, Turu & Mangasini, Usandawi.
Agama agama ufipae	Kipili, Ufipa on Lake Tanganyika.
Zonurus ukingensis	Tandala, Ukinga Mtns.
Amphisbaena mpwapwaensis	Mpwapwa, Ugogo.
Chamaeleon werneri dabagae	Dabaga, Uzungwe Mtns.
Chamaeleon incornutus	Madehani, Nyamwanga & Nkuka Forest, Rungwe.
Chamaeleon laterispinis	Kigogo, Uzungwe Mtns.

In addition to the new species, the following are recorded from Tanganyika Territory for the first time:

Pelusios nigricans rhodesianus Hewitt of Northern Rhodesia
Typhlops graueri Sternfeld of Belgian Ruanda
Philothamnus semivariegatus dorsalis (Bocage) of Angola
Rhamphiophis acutus (Günther) of Angola
Vipera superciliaris Peters of Mozambique
Atractaspis aterrima Günther of West Africa, already known from Uganda
Paragonatodes quattuorseriatus (Sternfeld) of Belgian Ruanda
Lygodactylus picturatus gutteralis (Bocage) of Portuguese Guinea
Lygodactylus angularis Günther of Nyasaland
Ichnotropis bivittata Bocage of Angola
Chameleon anchietae Bocage of Angola
Brookesia platyceps (Günther) of Nyasaland

while the undermentioned are revived:

Homalosoma shiranum Boulenger as a race of *Duberria lutrix* (Linnaeus)
Rhamphiophis rostratus Peters for East African "*R. oxyrhynchus* (Reinhardt)"
Lygodactylus angularis Günther sunk in *L. picturatus* (Peters) by Tornier
Sepacontias modestus Günther as a race of *Riopa sundevallii* (Smith)

Certain reptiles, hitherto regarded as full species, are accorded subspecific rank, thus:

Typhlops excentricus Procter as *Typhlops schlegelii excentricus* Procter
Lycophidium acutirostre Günther as *Lycophidion capense acutirostre* Günther
Leptophis dorsalis Bocage as *Philothamnus semivariegatus dorsalis* (Bocage)

Homalosoma shiranum Boulenger as *Duberria lutrix shiranum* (Boulenger)
Boulengerina stormsi Dollo as *Boulengerina annulata stormsi* Dollo
Nucras kilosae Loveridge as *Nucras boulengeri kilosae* Loveridge
Sepacontias modestus Günther as *Riopa sundevallii modestum* (Günther)

The following are considered strict synonyms:

Typhlops tornieri Sternfeld	=*Typhlops punctatus punctatus* (Leach)
**Typhlops humbo* Bocage	=*Typhlops schlegelii mucruso* (Peters)
**Typhlops mandensis* Stejneger	=*Typhlops schlegelii mucruso* (Peters)
Typhlops opisthopachys Werner	=*Typhlops pinguis* Waite of Australia
**Glauconia merkeri* Werner	=*Leptotyphlops conjuncta* (Jan)
Glauconia latirostris Sternfeld	=*Leptotyphlops conjuncta* (Jan)
**Glauconia distanti* Boulenger	=*Leptotyphlops scutifrons* (Peters)
Gastropyxis orientalis Werner	=*Hapsidophrys lineata* Fischer
**Prosymna variabilis* Werner	=*Prosymna ambigua* Bocage
Amplorhinus taeniatus Sternfeld	=*Hemirhagerrhis kelleri* Boettger
**Rhamphiophis connali* Parker	=*Rhamphiophis oxyrhynchus* (Reinhardt)
Parkerophis Barbour & Amaral 1927	=*Chilorhinophis* Werner 1908 (1907)
**Atractaspis phillipsi* Barbour	=*Atractaspis microlepidota* Günther
Atractaspis magretti Scortecci	=*Atractaspis microlepidota* Günther
**Lygodactylus manni* Loveridge	=*Lygodactylus p. picturatus* (Peters)
Elasmodactylus triedrus Boulenger	=*Pachydactylus boulengeri* Tornier
Nucras emini Boulenger	=*Nucras b. boulengeri* Neumann
Melanoseps ater longicauda Tornier	=*Melanoseps ater* (Günther)
**Chamaeleon tempeli wolffi* Tornier	=*Chamaeleon tempeli* Tornier
Rhampholeon Günther 1874	=*Brookesia* Gray 1864

In addition to those species now considered synonyms, the under-mentioned should be removed from the East African list:

Sternfeld and Loveridge's records of *Typhlops dinga* (= *T. s. schlegelii*) for Tanganyika Territory.

Boulenger, Stejneger and Loveridge's records of *Typhlops schlegelii* for Uganda, Kenya and Tanganyika respectively.

Lönnberg's record of *Glauconia scutifrons* for Tanganyika Territory.

Loveridge's record for *Leptotyphlops distanti* for Tanganyika Territory.

All records of *Rhamphiophis oxyrhynchus* for which substitute *R. rostratus*.

All records of *Atractaspis rostrata* for which substitute *A. bibronii* of which it is a synonym.

All records of *Agama hispida distanti* for which substitute *A. h. armata*.

Nieden's record of *Latastia siebenrocki* for Kenya and Tanganyika.

Loveridge's records of *Lygosoma ferrandi* for Tanganyika Territory.

*Type or paratype examined.

ACKNOWLEDGEMENTS

I take this opportunity of expressing my great indebtedness to Mr. H. W. Parker (British Museum) and to Mr. V. FitzSimons (Transvaal Museum) for answering various queries involving the examination of long series of specimens and Mr. Karl P. Schmidt for examining various types in the Berlin Museum collection; also Mons. F. Angel (Paris Museum), Dr. F. Gaston de Witte (Congo Museum), Dr. Wilhelm Götz (Stuttgart Museum) and Mrs. H. T. Gaige (University of Michigan Museum of Zoölogy) for loaning specimens or affording me facilities for their examination. Without this generous coöperation it would have been infinitely more difficult to arrive at reasonable decisions.

*List of Species Collected**

Order Loricata — PAGE

Family CROCODYLIDAE 204

Crocodylus niloticus Laurenti 204

Order Testudinata

Family TESTUDINIDAE 206

Testudo pardalis Bell 206

**Testudo tornieri* Siebenrock 206

Family CHELONIIDAE 207

Eretmochelys imbricata (Linnaeus) 207

Family PELOMEDUSIDAE 208

Pelusios sinuatus (Smith) 208

**Pelusios nigricans nigricans* (Dondorff) 209

Pelusios nigricans rhodesianus Hewitt 210

**Pelomedusa galeata* (Schoepff) 211

Order Squamata

Suborder Ophidia

Family TYPHLOPIDAE 212

Typhlops graueri Sternfeld 212

**Typhlops punctatus punctatus* (Leach) 213

(*Typhlops schlegelii schlegelii* Bianconi) 214

**Typhlops schlegelii mucruso* (Peters) 216

**Typhlops schlegelii excentricus* Procter 220

(*Typhlops opisthopachys* Werner) 222

Family LEPTOTYPHLOPIDAE 223

Leptotyphlops emini (Boulenger) 223

*An asterisk opposite a species indicates that examples are available for exchange. Species in parentheses are discussed though not collected.

PAGE
(*Leptotyphlops longicauda* (Peters)) 223
Leptotyphlops conjuncta (Jan) 224
Family BOIDAE 226
Python sebae (Gmelin) 226
Family COLUBRIDAE 231
Subfamily Colubrinae
Natrix olivaceus (Peters) 231
Glypholycus bicolor Günther 232
Boaedon lineatus Duméril and Bibron 232
Lycophidion capense capense (Smith) 233
Lycophidion intermediates between *capense* and *acutirostre* Günther 234
Lycophidion capense uzungwensis Loveridge 235
Pseudaspis cana (Linnaeus) 235
Chlorophis emini (Günther) 236
Chlorophis hoplogaster (Günther) 236
Chlorophis neglectus (Peters) 237
Philothamnus semivariegatus semivariegatus Smith 237
Philothamnus semivariegatus dorsalis (Bocage) 238
(*Hapsidophrys lineata* Fischer) 239
Coronella semiornata Peters 240
Grayia tholloni Mocquard 240
Duberria lutrix shiranum (Boulenger) 241
Prosymna ambigua Bocage 244
Subfamily Dasypeltinae 245
Dasypeltis scaber (Linnaeus) 245
Subfamily Boiginae 246
Tarbophis semiannulatus (Smith) 246
Crotaphopeltis hotamboeia hotamboeia (Laurenti) 247
Crotaphopeltis hotamboeia tornieri (Werner) 248
Amplorhinus nototaenia (Günther) 250
Trimerorhinus tritaeniatus tritaeniatus (Günther) 250
Rhamphiophis acutus (Günther) 252
(*Rhamphiophis oxyrhynchus* (Reinhardt)) 252
Rhamphiophis rostratus Peters 253
Dromophis lineatus (Duméril and Bibron) 254
Psammophis subtaeniatus Peters 254
Psammophis sibilans (Linnaeus) 255
Psammophis biseriatus Peters 256

*An asterisk opposite a species indicates that examples are available for exchange. Species in parentheses are discussed though not collected.

PAGE
Psammophis angolensis (Bocage) 257
Thelotornis kirtlandii (Hallowell) 257
**Dispholidus typus* (Smith) 258
Calamelaps unicolor (Reinhardt) 260
Rhinocalamus dimidiatus Günther 261
Miodon gabonensis (Duméril) 261
Chilorhinophis gerardi (Boulenger) 262
Subfamily Elapinae 263
Boulengerina annulata stormsi Dollo 263
**Naja melanoleuca* Hallowell 270
**Naja nigricollis* Reinhardt 271
(*Dendraspis angusticeps* Smith) 273
Family VIPERIDAE 273
**Causus rhombeatus* (Lichtenstein) 273
Causus resimus (Peters) 274
Causus defilippii (Jan) 274
Vipera superciliaris Peters 275
**Bitis arietans* (Merrem) 276
Atheris barbouri Loveridge 277
Atractaspis irregularis (Reinhardt) 278
(*Atractaspis conradsi* Sternfeld) 279
(*Atractaspis bibronii* Smith) 280
(*Atractaspis aterrima* Günther) 281
(*Atractaspis microlepidota* Günther) 281
Suborder Lacertilia
Family GEKKONIDAE 282
Paragonatodes quattuorseriatus (Sternfeld) 282
**Hemidactylus mabouia* (Moreau de Jonnés) 283
**Hemidactylus persimilis* Barbour & Loveridge 284
Hemidactylus tropidolepis squamulatus Tornier 284
Hemidactylus werneri werneri Tornier 285
(*Hemidactylus werneri alluaudi* Angel) 285
**Hemidactylus brookii* Gray 286
Lygodactylus capensis capensis (Smith) 286
Lygodactylus stevensoni Hewitt 287
**Lygodactylus grotei* Sternfeld 287
**Lygodactylus picturatus picturatus* (Peters) 288
**Lygodactylus picturatus* var. on Mombasa Id. 289
**Lygodactylus picturatus* var. on Ukerewe Id. 290

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PAGE
**Lygodactylus picturatus gutturalis* (Bocage) 291
**Lygodactylus angularis* Günther 292
**Pachydactylus boulengeri* Tornier 293
(*Phelsuma laticauda* (Boettger)) 295
Family AGAMIDAE 296
**Agama hispida armata* Peters 296
**Agama agama lionotus* Boulenger 297
**Agama agama mwanzae* Loveridge 298
**Agama agama turuensis* Loveridge 299
**Agama agama dodomae* Loveridge 300
**Agama agama ufipae* Loveridge 300
**Agama atricollis* Smith 300
Family ZONURIDAE 301
Zonurus ukingensis Loveridge 301
Chamaesaura miopropus Boulenger 302
Family VARANIDAE 303
Varanus niloticus (Linnaeus) 303
Family AMPHISBAENIDAE 304
Amphisbaena mpwapwaensis Loveridge 304
Family LACERTIDAE 304
**Nucras boulengeri boulengeri* Neumann 304
**Latastia johnstonii* Boulenger 306
**Latastia longicaudata revoili* (Vaillant) 308
Ichnotropis bivittata Bocage 308
Ichnotropis squamulosa Peters 309
**Eremias spekii spekii* Günther 310
Family GERRHOSAURIDAE 311
(*Gerrhosaurus major major* Duméril) 311
**Gerrhosaurus major zechi* Tornier 311
**Gerrhosaurus flavigularis flavigularis* Wiegmann 312
Family SCINCIDAE 312
**Mabuya maculilabris* (Gray) 312
Mabuya planifrons (Peters) 315
**Mabuya megalura* (Peters) 316
**Mabuya varia varia* (Peters) 316
**Mabuya striata* (Peters) 319
Riopa fernandi (Burton) 320
**Riopa sundevallii sundevallii* (Smith) 320
**Riopa sundevallii modestum* (Günther) 322

*An asterisk opposite a species indicates that examples are available for exchange. Species in parentheses are discussed though not collected.

PAGE
Ablepharus boutonii africanus Sternfeld 323
Ablepharus wahlbergii (Smith) 324
Ablepharus megalurus Nieden 325
Melanoseps ater (Günther) 326
Family ANELYTROPIDAE 328
Feylinia currori elegans (Hallowell) 328
Suborder Rhiptoglossa
Family CHAMAELEONTIDAE 329
Chamaeleon gracilis gracilis Hallowell 330
**Chamaeleon dilepis roperi* Boulenger 330
**Chamaeleon dilepis quilensis* Bocage 331
**Chamaeleon dilepis dilepis* Leach 332
**Chamaeleon bitaeniatus bitaeniatus* Fischer 333
**Chamaeleon bitaeniatus höhnelii* Steindachner 333
Chamaeleon anchietae Bocage 333
**Chamaeleon goetzei* Tornier 334
**Chamaeleon tempeli* Tornier 335
**Chamaeleon fülleborni* Tornier 338
**Chamaeleon werneri werneri* Tornier 338
Chamaeleon werneri dabagae Loveridge 339
**Chamaeleon jacksoni vauerescecae* Tornier 340
**Chamaeleon incornutus* Loveridge 340
Chamaeleon laterispinis Loveridge 341
(*Brookesia temporalis* (Matschie)) 342
**Brookesia platyceps* (Günther) 343

Systematic List of Species Collected

CROCODYLIDAE

Crocodylus niloticus Laurenti

Crocodylus niloticus Laurenti (part), 1768, Syn. Rept., p. 53: "Habitat in India orientali, et Aegypto."

Skin and skull (M. C. Z. 30000) Mwaya, Lake Nyasa. 6. iii. 30.

Distribution. Crocodiles were also seen on an affluent of the Ruvu River close to Bagamoyo; two were observed lazily swimming on the surface of Lake Tanganyika in Nyamkolo bay just after sun-up. They remained for a couple of hours. One was seen at Ukerewe Island and very many on Lake Victoria just above the Ripon Falls.

*An asterisk opposite a species indicates that examples are available for exchange. Species in parentheses are discussed though not collected.

Native name. *Mamba* (Kiswahili); *ngwina* (Kinyakusa).

Measurements. The female listed above measured ten feet four inches (Head and body 1470 mm., tail 1400 mm., hindfoot 180 mm.).

Diet, etc. On three occasions we crossed and recrossed the Mbaka River in an unusually crazy dugout tree-trunk. In fact during the ten days spent at Mwaya it was a matter of daily occurrence to cross some river or other but the dugout available on the Mbaka River was an exceptionally unstable and leaky affair with never less than three or four inches of water in the bottom. One day this dugout capsized both on the outward and return journey and shot my "boys" into the water. Salimu was highly incensed for, in addition to getting the cartridges wet, he lost some money and other belongings which were in his pocket at the time. He said that the ferryman told him that never a day passed without the dugout being upset. On the 5th of March I crossed at 7 a.m. and returned about 2 p.m., I was informed that crocodiles had taken two women at the crossing during the interval I had been away. The unfortunate women had waded into the water to fill their water pots. Turning to the chief's son, who accompanied me, I asked him how many people were taken in his district by crocodiles each month; he replied that about five were killed in this way and that they were mostly women engaged in drawing water. I asked why, seeing that bamboo was abundant, they did not follow the custom of intelligent natives such as those in the Morogoro district and bail the water from a distance by means of a gourd attached to the end of a bamboo. "Too much trouble," he replied. I said I would shoot any crocodiles that I could if his people would come and tell me when they saw one basking. At 1 p.m. the following day I was summoned to shoot a crocodile that was lying, mostly concealed by grass in shallow water on the further side of the river. I could just see the top and back of its head and the first shot, a .351 soft-nose bullet, right between the eyes was instantaneous in effect; a violent lashing of the tail accompanied by quivering of the limbs and in a minute all was still though there was an ever widening red patch on the water. The stomach held nothing but pebbles and sand.

In strange contrast to the voracity of the crocodiles at Mwaya is their apparent indifference to the natives at both Nyamkolo and Kasanga near the southern end of Lake Tanganyika. At both places the natives, particularly the children, bathed freely near the shore. In answer to my enquiries nobody seemed to recall a case of a crocodile carrying off a person. Nevertheless my native personnel refused to bathe, preferring to bail out water and perform their ablutions at a

safe distance. When I invited Salimu's attention to the fact that little children were bathing with impunity though he and his companions would not, he replied that, "In many houses you may have noticed that a dog and cat will live together in amity but if a strange dog or cat appears the results may be different. These people and these crocodiles know each other of old but I do not know these crocodiles nor they me."

Parasites. Nematodes were found in the body cavity of the Mwaya crocodile.

TESTUDINIDAE

Testudo pardalis Bell

Testudo pardalis Bell, 1828, Zoöl. Journ., **3**, p. 420: Africa.

1 (M. C. Z. 30001) Saranda, Ugogo. 17. xii. 29.
1 (M. C. Z. 30002) Tukuyu, Rungwe. 13. iii. 30.

Distribution. A tortoise was described to me as occurring on Ukerewe Island which could be none other than the Leopard Tortoise though I failed to secure one during my brief stay. It has been recorded by Sternfeld.

Native name. Malugangi (Kigogo).

Habitat. The halfgrown male from Saranda was found walking about in the rather sandy thorn-bush country just before sunset. At the time the scanty grass was very dry after a prolonged drought.

Diet. Two very large examples from Kabete were given to me by Miss Gladys Leakey to take home to the London Zoölogical Society's gardens. Hitherto they had been fed on the foliage of ground nuts. On board I fed them every second day on lettuce and moistened soft bread of which they consumed quantities and it was rarely that they failed to clear up every leaf and crumb. Once or twice during the hot weather in the Red Sea they were soaked for an hour or so in a bath tub at which times they would drink deeply; they arrived in fine condition.

Testudo tornieri Siebenrock

Testudo tornieri Siebenrock, 1903, Ak. Wiss. Wien, Math.-nat. Klasse, **24**, p. 185: "Bussisia" *i.e.* Busisi, Tanganyika Territory. Loveridge, 1928, Proc. U. S. Nat. Mus., **73**, Art. 17, p. 49; Tabora; Dodoma; Mfilima; Kikombo; Kibakwe; Kondoa Irangi, Tanganyika Territory.

Testudo (*Malacochersus*) *tornieri* Lindholm, 1929, Zoöl. Anz. Leipzig, **81**, p. 285.
Testudo loveridgii, E. G. Boulenger, 1920, Proc. Zoöl. Soc. London, pp. 190–1.

8 (M. C. Z. 30003–10) Mangasini, Usandawi. 13–16. xii. 29.

Distribution. The locality is a new one for the Soft-shelled Land Tortoise.

Variation. In general tortoises in this series present a fairly normal condition; all have four costals on either side of the five vertebrals and all but one have the normal eleven pairs of marginals, the exception (M. C. Z. 30008) has twelve pairs. Two tortoises (M. C. Z. 30003, 30009), however, display a striking variation of the nuchal shield which is not merely completely divided on the longitudinal axis but the two halves are separated by a wide V-shaped cleft. The description of the species should read, therefore, "a single nuchal, more rarely two." No. 30009 has the supracaudal apparently completely divided below, all have the normal pseudo-suture of the supracaudal as seen from above.

Measurements. The largest, a female, measures 174 mm. in length, 118 mm. in breadth, and 38 mm. in depth.

Notes. On December 13 an adult and four young were taken under shelter of rocks but exposed. These were shown to the local natives who brought in a dozen more, of which nine juveniles were sent alive to the Zoölogical Society of London for experimental feeding with a view to developing the exoskeleton; unfortunately only two survived the voyage.

CHELONIIDAE

Eretmochelys imbricata (Linnaeus)

Testudo imbricata Linnaeus, 1766, Syst. Nat., Ed. 12, **1**, p. 350: American Seas:

1 (M. C. Z. 30011) Mombasa, Kenya Colony. 9. vii. 30.

Distribution. This turtle was bought in the native fish-market where it had been lying unfed for several weeks. Being inedible, Hawksbill Turtles are presumably kept to sell as curios to the occasional visitors who discover the interesting market which is hidden away behind the old customs warehouse at Mombasa. Hawksbill Turtles have frequently been recorded from localities on the East African coast.

PELOMEDUSIDAE

Pelusios sinuatus (Smith)

Sternothaerus sinuatus A. Smith, 1838, Illus. Zoöl. S. Africa, **3**, pl. i: South Africa, "in rivers to the north of 25° S. latitude." *i.e.* region of the headwaters of the Limpopo River.

Pelusios sinuatus Loveridge, 1929, U. S. Nat. Mus. Bull. No. 151, p. 15: Juja Farm, Kenya Colony; Ujiji, Tanganyika Territory.

2 (M. C. Z. 30012–3) Ujiji, Lake Tanganyika. 28. v. 30.

Distribution. Sternfeld has recorded this terrapin from Lake Tanganyika and Roux a juvenile example from Bukoba, Lake Victoria.

Native name. Fulwe (Kijiji).

Variation. The remarks made about Raven's specimens from Ujiji in 1929 apply with equal force to these examples. I am still unconvinced that Hewitt's *P. s. zuluensis* is anything more than a local variant but our material is insufficient to form a considered opinion. Certainly our three Ujiji terrapin have conspicuous median protuberances on vertebrals III and IV (*i.e. zuluensis*) but their two hindmost marginals are directed downwards very strongly (as in *sinuatus*); on the other hand a terrapin of the same size from Mt. Chirinda, S. Rhodesia recently received from Dr. J. H. Sandground has the protuberance on the fourth vertebral even more pronounced than in the Ujiji examples (*i.e. zuluensis*) and its two hindmost marginals are distinctly upturned (*i.e. zuluensis*). I doubt if much reliance can be placed on this marginal character as in 250 *Testudo tornieri* from Dodoma every variation was seen, some marginals being so upturned as to form a perfect gutter.

Measurements. Both are young being from 80 to 88 mm. in length.

Breeding. As Mr. H. C. Raven had secured two terrapin at Ujiji in 1920 I visited the place in the hope of securing a good series. The fishermen, however, did not produce any and told me that July is the month in which they take large numbers of these reptiles. In July, they said, the weather and water are warm and the turtles come out to lay their eggs.

Enemies. While some of the Ujiji natives scornfully denied eating terrapin, others admitted that they did eat them.

Habitat. The two specimens collected were found at the bottom of a twenty-foot-deep, cement-lined pit in an old ruin. The pit held about eighty gallons of stagnant water and this we had to bail out in order to secure the reptiles.

Pelusios nigricans nigricans (Dondorff)

Testudo nigricans Dondorff, 1798, Zoöl. Betyr. des Linn. natur., **3**, p. 34: Type locality unknown.
Sternotherus nigricans nigricans Siebenrock, 1909, Zoöl. Jahrb. Syst., **3**, p. 558.
Pelusios nigricans nigricans Hewitt, 1931, Ann. Natal Mus., **6**, p. 460.

2 (M. C. Z. 30016–7) Ukerewe Id., Lake Victoria. 11. v. 30.
2 (M. C. Z. 30018–9) Entebbe, Lake Victoria. 28. vi. 30.

Variation. Heretofore I have followed Siebenrock in referring East African terrapin to *P. nigricans castaneus* (*Emys castanea* Schweigger, 1814, Prodr. Chelon., p. 45: Type locality unknown) for he gives the ranges as follows:

Southeast Africa, Rhodesia, Mozambique, Matabeleland, East Madagascar........................ *n. nigricans*
South Africa, from Natal to the Equator, and from the East Coast to the Congo watershed in the West; Pemba Island; West Madagascar............... *n. castaneus*

It will be seen that there is a considerable area of overlapping and when one attempts to identify material by the synopsis furnished by Siebenrock the results are equally bewildering. For example:

Anterior border of the second vertebral longer than the posterior................................ *n. nigricans*
Anterior border of the second vertebral shorter than the posterior................................ *n. castaneus*

In one Ukerewe specimen (No. 30016) they are equal, in No. 30017 from the same locality the anterior is a trifle longer; in No. 30018 from Entebbe they are equal, in No. 30019, also from Entebbe the anterior is a trifle shorter. Similar difficulties arise when attempting to apply the other characters alleged to differentiate the forms.

More recently Hewitt has produced a key as follows:

Shell short, broad and depressed; marginals V–VII with dorsal and ventral surfaces gradually merging; intergular shield pear-shaped and longer than the anterior border of the humeral; outer border of femoral strongly arched. East Africa........ *P. n. nigricans*
Shell much compressed laterally; marginals V–VII having no lateral edge and no definite dorsal and ventral surfaces; length of outer border of pectoral shield a trifle less than, or subequal to, that of the outer border of the humeral; intergular shield pear-shaped, decidedly longer than the inner

border of the humeral; outer border of femoral slightly arched, and measured in a straight line it considerably exceeds the abdominal. Locality? . . *P. n. castaneus*

East African terrapin certainly have broad and depressed shells; I fail to see any difference in the marginal characters; the shape and length of the intergular shield varies greatly; it is, however, pear-shaped on the average and in all the score of specimens at my disposal it is longer than the inner border of the humeral; generally speaking, the outer border of the femoral is strongly arched except in larger terrapin and occasional specimens where it is certainly only slightly arched. I strongly suspect that Boulenger was right in relegating *castaneus* to the synonymy of *nigricans*.

While terrapin of this genus from a given locality or lake often exhibit a family likeness, adequate series from any one place usually reveal the fact that few characters are absolutely constant. For example Hewitt states that the outer borders of the pectoral and humeral shields are equal in *nigricans*, subequal in *P. n. rhodesianus*. In a series of six *nigricans* from Dodoma only three have these outer borders equal, in the other three the outer border of the humeral is much longer than that of the pectoral; in the whole series there is much variation in this character.

Measurements. The greatest shell length is to be found in the Ukerewe Island terrapin of which the larger is 235 mm., the smaller specimen from Entebbe is 180 mm.

Enemies. The two examples from Entebbe are only deviscerated shells found upon the lake shore; according to native reports these terrapin are killed and eaten by the African Sea Eagle (*Cuncuma vocifer vocifer*) a species that is much in evidence on the lake.

PELUSIOS NIGRICANS RHODESIANUS Hewitt

Pelusios nigricans rhodesianus Hewitt, 1917, Rec. Albany Mus., **3**, p. 375, pl. 21, figs. 2 and 3: Mpika District, Northeast Rhodesia.

1 (M. C. Z. 30014) Mwaya, Lake Nyasa. 1–8. iii. 30.
1 (M. C. Z. 30015) Nyamkolo, N. Rhodesia. 9. v. 30.

Native name. Kajamba (Kinyakusa).

Affinities. P. n. rhodesianus unfortunately escaped the Zoölogical Record owing to the name being proposed in the body of the text under the heading of the typical form only. It was based on a series of which the exact number is not stated, from Mpika District which

is about 225 miles due south from Nyamkolo where one of the specimens listed above was obtained.

The new form is said to differ from *P. nigricans* from the Congo as figured by Schmidt (1919, Bull. Am. Mus. Nat. Hist., **39**, p. 411, fig. 1) and also from a Pemba Island specimen figured by Siebenrock (1906, in Voeltzkow, Reise in Ostafrika, **3**, p. 36, pl. 5, fig. 18) under the name of *S. n. castaneus* in the character of the intergular shield which is long and narrow in Schmidt's figure, somewhat pear-shaped in Siebenrock's, and diamond shaped in *rhodesianus* of which there is an excellently reproduced photograph, and also a figure of a young terrapin from Mpika District.

The elongated, almost parallel-sided, shape of the intergular in Schmidt's figured specimen, which was only 67 mm. in length, is quite characteristic of the young of *P. n. nigricans;* with growth the sides bulge out until the scale attains the somewhat pyriform shape shown in Siebenrock's plate. When our series of *nigricans* (consisting of a score of East African, as well as a Pemba Island and a Western Malagasy terrapin) is arranged according to size (46 to 325 mm.) this development is readily seen, but none approximate to the appearance of *rhodesianus* more closely than the two examples listed above. The two forms may be distinguished as follows:

Intergular shield not, or but slightly, narrowed anteriorly showing a broad free edge on the border of the plastron . . . . *P. n. nigricans*

Intergular shield much narrowed anteriorly being nearly excluded from the border of the plastron by the gulars . . . . *P. n. rhodesianus*

In all other respects these *rhodesianus* agree with our series of *nigricans*, though in the description where "costal viii" is said to be "apparently not meeting the abdominal shield in full-grown specimens," it is obvious that marginal viii was intended.

Measurements. Length of Mwaya terrapin 125 mm. Length of Nyamkolo terrapin 110 mm.

PELOMEDUSA GALEATA (Schoepff)

Testudo galeata Schoepff, 1792, Hist. Testud., p. 12, pl. 3, fig. 1: "Habitat in India orientale, Carolina."

14 (M. C. Z. 30020–33) Mangasini, Usandawi. 13. xii. 29.

Distribution. A large Helmeted Terrapin was brought in by a native when I was camped on Ukerewe Island, 19. vi. 30. Unfortu-

nately it escaped the same night. I examined a small specimen taken on the island which was in the collection of Père Conrads. The species has been recorded from Ukerewe by Sternfeld.

Native name. *Malwala* (Chigogo).

Measurements. The largest specimen from Mangasini is a female of 179 mm., the largest male is 164 mm., the youngest terrapin is only 44 mm.

Habits. The initial downpour of the lesser rains occured at Mangasini on December 12, 1929, and lasting from 6 p.m. till noon on the 13th brought these terrapin in great numbers from their aestivating quarters. Some were encountered in the water course which held a torrent the night before; others were taken in freshly-formed pools.

TYPHLOPIDAE

Typhlops graueri Sternfeld

Typhlops graueri Sternfeld, 1912, Wiss. Ergebn. Deutsch-Zentral-Afrika-Exped., **4**, p. 264: Rain forest behind Randbergen, Belgian Ruanda-Urundi.

2 (M. C. Z. 30034–5) Ujiji, Lake Tanganyika. 30. v. 30.

Distribution. Hitherto only known from the holotype. The present specimens were taken at Ruanda a few miles east of Ujiji and not to be confused with Ruanda in the Belgian Mandated Territory a hundred and fifty miles to the north.

Native name. *Kisambwe* (Kijiji).

Were it not that Ujiji is also the type locality of *Amphisbaena phylofiniens* it would be a matter of surprise to find a rain-forest species in such a hot and low-lying spot as Ujiji but the process of deforestation and desiccation that has been in progress for centuries may be actually observed two hundred and fifty miles south of Ujiji at Kitungulu, the type locality of *Typhlops gracilis* Sternfeld.

Affinities. *T. gracilis* only differs from *T. graueri* in two particulars and perhaps the relationship would be better expressed by making *graueri* a race of *gracilis.* The rostral shields of both are strikingly different from that of *T. uluguruensis;* those of the former, or at least of *graueri,* are enormous and truncated posteriorly, that of *uluguruensis* is only "very large" and sharply pointed posteriorly.

In this connection I should like to draw attention to an unfortunate error of transposition in the table of these and allied forms in Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 104 where 1st

and 2nd labials under *gracilis* and *uluguruensis* are transposed; correctly restated these should read:—

Character.	*T. graueri*	*T. gracilis*	*T. uluguruensis*
Scale rows.	24	22	20
Times the body diameter is contained in length.	51–61	80	48–51
The nasal is divided from rostral to the.	1st labial	1st labial	2nd labial
Labials with which the ocular is in contact.	2nd and 3rd	2nd and 3rd	3rd and 4th
The subocular is.	absent	absent	absent
The snout has a.	sharp horizontal edge	sharp horizontal edge	bluntly rounded outline

The description of *graueri* being very meagre, the following, drawn up independently of it and based on the two Ujiji snakes, is given.

Description. Snout prominent, with sharp horizontal edge, nostrils inferior; rostral enormous, 3 mm. in length, nearly as long as the breadth of the head, extending backwards far beyond an imaginary line connecting the commissures of the mouth; eye indistinguishable; nostril divided, the suture extending from the 1st labial through the nostril to the rostral; no preocular or subocular; ocular small, in contact with the 2nd and 3rd upper labials; three upper labials; three lower labials. Diameter of body contained 51–61 times in the total length (60 times in Sternfeld's type); 24 midbody scale rows; tail slightly longer than broad in the male, much shorter than broad in the female, sharply pointed, the tip spine-like.

Coloration. Uniformly flesh-pink in life; colorless or plumbeus in alcohol.

		♂	♀
Measurements.	Length of head and body	300 mm.	202 mm.
	Length of tail	5 mm.	2 mm.
	Diameter at midbody	5 mm.	4 mm.

The total length of Sternfeld's type was 355 mm.

Habitat. Captured alive by Salimu in an area of low-lying rice plantations at Ruanda.

Typhlops punctatus punctatus (Leach)

Acontias punctatus Leach, 1819, in Bowdich, Miss. Ashantee, p. 493: Fantee, Gold Coast.

Typhlops tornieri Sternfeld, 1910, Mitt. Zoöl. Mus. Berlin, **5**, p. 69: Kilimanjaro, Tanganyika Territory.

2 (M. C. Z. 30036–7) Ujiji, Lake Tanganyika. 28. v. 30.
1 (M. C. Z. 30038) Mwanza, Lake Victoria. 6. vi. 30.
1 (M. C. Z. 30039) Ukerewe Id., Lake Victoria. 10. vi. 30.
2 (M. C. Z. 30040–1) Mabira Forest, Uganda. 1. vii. 30.
1 (M. C. Z. 30042) Jinja, Uganda. 2. vii. 30.

Distribution. Recorded from Bukoba by Roux.

Native name. Ndumiakitwili (Kijiji).

Variation. The eyes are indistinguishable in one of the Mabira Forest snakes which is obviously about to slough; they present various stages of distinctness in the rest of the series; presumably being most distinct in those snakes which have sloughed most recently. As a key character, the distinctness or otherwise of the eye should be used with caution. *T. tornieri* Sternfeld seems to have been separated solely on this character. Mr. K. P. Schmidt has recently reëxamined one of the types of *tornieri* and informs me that he could distinguish the eye and that the preocular is really in contact with the second and third labials.

In one Ujiji snake (No. 30037) the nasal is completely divided on both sides; in the Jinja reptile it is completely divided on the left side only, the right side being in the normal condition of incompletely divided. This is another key character which cannot be wholly relied on. All agree in possessing 28 midbody scale-rows.

Coloration. The coloration of this series is remarkably uniform and answers to Boulenger's variety B. b. (i.e. *T. lineolatus*) except No. 30037 where the yellow spots being absent dorsally the entire upper surface is dark brown while beneath the yellow spots have coalesced to form large blotches resulting in a mottled ventral surface.

Measurements. The diameter of the body is included in the length from 29 to 33 times (24 to 30 in Boulenger, 1893, Cat. Snakes in Brit. Mus., **1**, p. 42). In size the series ranges from 300 mm. (Mabira) to 470 mm. (Ujiji).

Parasites. Nematodes (*Kalicephalus sp.*) were found in the snake from Ukerewe Island.

Habitat. The Jinja reptile was taken just before sunset as it was wriggling along in a furrow, which served as a gutter, at the side of the road.

Typhlops schlegelii schlegelii Bianconi

Typhlops schlegelii Bianconi, 1850, Spec. Zoöl. Mosamb., p. 13, pl. iii, fig. 1: Inhambane, Mozambique.

Onychocephalus dinga Peters, 1854, Monatsb. Akad. Wiss. Berlin, p. 620: Tete; Sena; Chupanga, Mozambique.
Onychocephalus mucruso Peters (part), 1854, Monatsb. Akad. Wiss. Berlin, p. 621: Tete, Mozambique.
Onychocephalus varius Peters, 1860, Monatsb. Akad. Wiss. Berlin, p. 82: Sena, Mozambique.
(*Onychocephalus*) *riparius* Peters, 1881, Sitzber. Ges. naturf Freunde, Berlin, p. 50: Chupanga, Mozambique.

In an attempt to ascertain what name should be applied to certain blind snakes collected northeast of Lake Nyasa, I found it necessary to examine very thoroughly the extremely involved status of many species described from this region.

The oldest name available was *schlegelii* with 40 midbody scale rows, the next *dinga* with 34 to 40. The latter had been referred to the synonymy of the former by Bocage but this conclusion was not accepted by Boulenger. As no East African material from north of the Zambesi possesses more than 38 scale rows and averages much less, it became apparent that one might recognize a form in extreme southeast Africa, south of the Zambesi, this nominate form being characterized by 34 to 40 (increased to 44 by Boulenger) scale rows.

In the absence of natural barriers I somewhat arbitrarily refer Southern Rhodesian and Transvaal specimens to this race though at the present time no examples from these colonies are known to me which have more than 38 scale rows, yet they undoubtedly average a higher count than do snakes from further north.

For study 18 snakes of this form were available, 16, including a cotype of *dinga*, in the collection of the Museum of Comparative Zoölogy, and 2 borrowed from the United States National Museum and the British Museum. Of these 3 come from Mozambique south of the Zambesi (Tete; Mezi (?Muase) River; Chifumbazi); 13 from Southern Rhodesia (Bulawayo; Chikore; Mount Chirinda; Eldorado and Kafue River); 2 from the Transvaal (Barberton).

These 18 snakes have from 32–38 midbody scale rows (average 34.4); the rostral is broader than long in 16 snakes, as broad as long in 1 snake, longer than broad in 1 snake; the eye is beneath the ocular in 5 snakes or beneath the suture between the ocular and preocular in 13 snakes; the nasals are separated behind the rostral in 14 snakes, or in contact in 4 snakes. The lengths range from 164 to 740 mm.; midbody diameters from 6 to 28 mm., the latter being contained in the total length from 25 to 35 times. In this connection it might be added that the cotype of *dinga* which, according to Peter's measure-

ments, had its diameter 41 times in the length, according to my findings is only 35 times for its diameter is 7 mm., not 6 as stated by Peters.

Typhlops schlegelii mucruso (Peters)

Onychocephalus mucruso Peters (part), 1854, Monatsb. Akad. Wiss. Berlin, p. 621: Macanga (i.e. Makanga), Mozambique.

O (*nychocephalus*) *petersii* Bocage, 1873, Jorn. Sci. Lisboa, **4**, p. 249: Biballa, Angola.

Typhlops (*Onychocephalus*) *humbo* Bocage, 1886, Jorn. Sci. Lisboa, **11**, p. 171: Quisange, Benguella, Angola.

Typhlops mucruso Boulenger (part), 1893, Cat. Snakes Brit. Mus., **1**, p. 36: Zanzibar; East Africa; Angola.

Typhlops hottentotus Bocage, 1893, Jorn. Sci. Lisboa, **3**, p. 117: Quindumbo, Angola.

Typhlops mandensis Stejneger, 1893, Proc. U. S. Nat. Mus., **16**, p. 725: Wange, mainland *opposite* Manda Island, Kenya Colony. Loveridge (part), 1929, U. S. Nat. Mus. Bull. No. 151, p. 16.

Typhlops schlegelii Stejneger (*nec.* Bianconi), 1893, Proc. U. S. Nat. Mus., **16**, p. 725: Wange, *opposite* Manda Island, Kenya Colony.

Typhlops dinga Sternfeld (*nec.* Peters), 1911, Sitzb. Ges. naturf Freunde, Berlin, p. 248: Tabora, Tanganyika Territory.

Typhlops latirostris Sternfeld, 1910, Mitt. Zoöl. Mus. Berlin, **5**, p. 70: Tabora, Tanganyika Territory.

Typhlops punctatus Loveridge (*nec.* Leach), 1923, Proc. Zoöl. Soc. London, p. 872, and Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 106: Both records of juveniles from Dar es Salaam, Tanganyika Territory.

6 (M. C. Z. 30043–8) Bagamoyo. 11–16. xi. 29.
1 (M. C. Z. 30049) Mangasini, Usandawi. 14. xii. 29.
11 (M. C. Z. 30050–60) Mwaya, Lake Nyasa. 1–8. iii. 30.
1 (M. C. Z. 30061) Tukuyu, Rungwe district. 13. iii. 30.

Native name. *Dumilakosa* (Kinyakusa).

Distribution. I am now restricting the nominate form, *T. s. schlegelii,* together with its synonym *dinga* to East Africa south of the Zambesi (*vide antea*). The next available name is *mucruso* if we restrict its use to the type from Makanga, for *mucruso* as described by Peters was a composite of the two races. This policy is followed as *mucruso* has long been in use for East African specimens and *petersii,* which was next proposed, was long ago referred to the synonymy of *mucruso* by Boulenger.

Synonymy. T. humbo has had rather a complicated history. It was recognized as distinct by Boulenger at the time of the publication of the Catalogue of Snakes, but having no topotypic specimens he incorrectly assumed that a Mpwapwa snake which he had was identical and substituted his own description of the Mpwapwa snake for that of Bocage's Angolan reptile. I have seen two topotypes of *humbo* which is undoubtedly a synonym of *mucruso*, a conclusion reached by Boulenger in 1915. I have also seen the Mpwapwa snake which I refer to *T. schlegelii excentricus* Procter.

T. mandensis. This snake was described as from Wange, Manda Island and collected by Gustave Denhardt. Denhardt's plantation at Wange is, however, not on the island but on the mainland twenty miles north of Manda Island and there are no topographical grounds therefore for considering it different from *mucruso* which occurs along the coast further south.

From 1893 to 1923 no second specimen was reported until I recorded one from Morogoro, which I now consider was a *T. schlegelii excentricus* that was blind and colorless because about to slough. This Morogoro snake is in the British Museum.

The characters in which *mandensis* and *mucruso* were supposed to differ may be contrasted as follows:—

	mandensis	*mucruso*
(a) Horizontal edge of snout..........	obtusely angular	sharply angular
(b) Eyes............................	hidden	distinct
(c) Diameter of body into length......	23 times	23 to 38 times
(d) Midbody scale-rows..............	34	30–38

(a) As shown below under "*punctatus*," an obtusely angular snout is normal in the young of *mucruso*, but becomes sharply angular in the adult. The type of *mandensis*, which I have examined, is a young animal measuring 135 mm.

(b) Elsewhere (1923, Proc. Zoöl. Soc. London, p. 873) I have drawn attention to a *T. s. excentricus* which, when taken at Kilosa, was "whitish, or flesh-colored, with *the eyes completely hidden* but after a period of captivity was found to be normally colored and the eyes distinct." It therefore seems probable that prior to sloughing the old epidermis becomes opaquely white and the eyes invisible. The color description of *mandensis* lends support to this view, "Uniform pale greenish-gray above, pale buff beneath." The Morogoro snake referred by Boulenger and myself to "*mandensis*" was still more so for it was "colorless except for a little buff on the belly."

(c) At the time of the publication of the description of *mandensis* the range of diameter into length for *mucruso* was only 25 to 35 times, it has since been extended and includes that of *mandensis*.

(d) The midbody scale-rows have always been within the recognized range of variation for *mucruso*, even in 1893.

T. "*schlegelii*." The snake referred to *schlegelii* by Stejneger was collected with the type of *mandensis* at Wange. It is half-grown and has 34 scale-rows. I consider it identical with *mucruso* which has been reported from Lamu (near Wange) by Sternfeld. I have also examined the snake from the Lado Enclave which Boulenger referred to *schlegelii*, it has 38 scale-rows which is high for so northerly a specimen, in other respects it is identical with Uganda *mucruso*.

T. latirostris. Sternfeld described this snake on the basis of an individual which was colorless and about to slough. He referred other Tabora specimens to *mucruso* and *dinga*. Boulenger synonymised *latirostris* with *mucruso* in 1915.

T. "*punctatus*." Possibly Sternfeld's record of this species from Tabora is based on a juvenile as were mine from Dar es Salaam. A few years ago the Museum of Comparative Zoölogy received from Dr. J. H. Sandground a series (M. C. Z. 29167–29174) of eight snakes from Mt. Chirinda, Southern Rhodesia, which range in size from 195 to 740 mm. I refer these to *T. s. schleglii*. I had never seen so fine a developmental series from one locality and was immediately struck by the similarity of the smallest to the three young Dar es Salaam snakes which I had previously referred to *punctatus*, the intermediate to half-grown snakes such as those listed above, and the largest to *mucruso* as figured by Peters in "Reise nach Mossambique," 1882, plate xiii, fig. 3. (The locality of the figured specimen not being stated it cannot be said whether it is *mucruso* as here restricted, or one of the Tete or Sena specimens referred to *T. s. schlegelii*, but this is immaterial to the discussion.)

I found that the snout in the smallest Chirinda snakes was obtusely angular as in adult *punctatus* but became progressively sharply angular with advancing age till it presents the appearance figured in Peter's *mucruso*. A comparison of the small Dar es Salaam snakes (130 and 296 mm.) with young Chirinda specimens (195 and 275 mm.) showed them specifically identical in every respect, even to details of coloration. They are regarded as racially distinct as specimens from south of the Zambesi do attain a higher scale-count.

Variation. The 19 snakes listed above have from 30–36 midbody scale-rows (average 32.1); the rostral broader than long in the adults,

about as broad as long in the young; the eye, when visible, is beneath the ocular or beneath the suture between the ocular and preocular; the nasals are separated behind the rostral in 17 snakes, or in contact in 2 snakes.

Seven snakes were borrowed from the British Museum for comparison. These came from Zanzibar; Mombasa, Kenya Colony; Uganda; Lado Enclave; Lake Tanganyika and Quisange, Angola and had been previously identified variously as *T. schlegelii*, *T. mucruso*, *T. varius* and *T. humbo*.

These 7 snakes have from 30 (Mombasa) to 38 (Lado and Quisange) midbody scale-rows (average 35.1); the rostral is broader than long in all 7 snakes; the eye is beneath the ocular; the nasals narrowly or broadly separated behind the rostral. The lengths range from 273 to 610 mm.; midbody diameters from 11 to 23 mm.; the latter being contained in the total length from 23 to 34 times.

It may be possible to differentiate a form with very large rounded rostral like a trench helmet as opposed to a moderately large rostral with lateral sides almost parallel, so many intermediate conditions occur that I failed, nor did this variation appear to occur with any geographical significance. In Peter's figures are shown two types of head, one in which the head passes gradually into the body, the other in which the head seems disproportionately small. These snakes lay up stores of fat, presumably for aestivation through the long dry season, and I suggest that this is responsible for the swollen bodies of some specimens; I may be wrong.

Measurements. Twenty-two Tanganyika snakes measure from 132 to 485 mm. in total length with midbody diameters of from 5 to 15 mm., being contained in the total lengths from 26 to 38 times as against 25 to 37 given by Boulenger in his 1915 key.

Diet. Ants were preserved from the stomach of one Bagamoyo snake while two leathery snake's eggs, measuring 14 x 6 mm. were found in the *stomach* of another.

Defence. An adult male emitted a very strong-smelling caecal discharge when first captured.

Habitat. This adult was actually taken at Kitopeni about five miles south of Bagamoyo where it was dug from sand at the base of a banana plant; a half-grown snake was taken in sand under debris beside a young coconut palm. It would appear as if very large adults, which are rarely encountered, live deeper underground than the smaller snakes, only coming to the surface when the first rains fall after a long dry season.

Typhlops schlegelii excentricus Procter

Typhlops humbo Boulenger (*nec.* Bocage) part, 1893, Cat. Snakes Brit. Mus., **1**, p. 46: Mpwapwa, Ugogo, Tanganyika Territory.

Typhlops excentricus Procter, 1922, Ann. Mag. Nat. Hist. (9), **9**, p. 685: Kilosa, Tanganyika Territory. Loveridge, 1923, Proc. Zoöl. Soc. London, p. 874: Kilosa.

Typhlops mandensis Loveridge (*nec.* Stejneger), 1923, Proc. Zoöl. Soc. London, p. 872: Morogoro, Tanganyika Territory.

Typhlops dinga Loveridge (*nec.* Peters), 1923, Proc. Zoöl. Soc. London, p. 873 and 1929, Bull. Antivenin. Inst. Amer., **3**, p. 14: Kilosa and Morogoro, Tanganyika Territory.

Typhlops mucruso var. *humbo* Loveridge (*nec.* Bocage), 1923, Proc. Zoöl. Soc. London, p. 873: Ilonga; Kidenge; Kilosa; Kipera; Madazini and Mpwapwa, Tanganyika Territory.

Typhlops mucruso Barbour & Loveridge (*nec.* Peters), 1928, Mem. Mus. Comp. Zoöl., **50**, p. 109: Kilosa; and Loveridge (part), 1929, U. S. Nat. Mus. Bull. No. 151, p. 17: Morogoro specimen only.

1 (M. C. Z. 30062) Morogoro, Ukami. 30. xi. 29.

Distribution. This color form is recognized because it is confined to a definite area in Central Tanganyika Territory in which *Typhlops schlegelii mucruso* is not known.

Variation. As a result of the knowledge gained as to age variation in *T. s. schlegelii,* I gathered together all the available blind snakes which I had collected at Morogoro, Kilosa and Mpwapwa and at villages in their vicinity. These consisted of thirteen snakes of which seven were topotypes of *excentricus,* in addition the data from the description of *excentricus* was added as well as the data from the British Museum specimen from Mpwapwa which was referred to *humbo* by Boulenger in 1893.

These fourteen snakes have from 30–36 midbody scale-rows; the rostral is broader than long below, or as broad as long; the eye, when visible, is beneath the ocular in 7 snakes or beneath the suture between the ocular and preocular in 7 snakes; the nasals are just in contact behind the rostral in 10 snakes or separated behind the rostral in 4 snakes.

It will be seen, therefore, that there is no scale character by which one may separate *excentricus* from *mucruso* and hence from 1923 onwards they have been considered synonymous. The large series of *mucruso* now available, however, leads me to separate the two forms on a basis of their coloration. This action had already been taken by

Sternfeld in 1910 though, following Boulenger, he erroneously applied the name *humbo* to *excentricus*, which had not been described at that time.

In *T. s. excentricus* the lower surface is colored and spotted like the back, such a form of coloration is only known to me from Morogoro, Kilosa, Mpwapwa and vicinity. *T. s. mucruso* on the other hand usually has the lower surface entirely white, or yellow, or at least a longitudinal median area of white, the upper surface being extremely variable.

In describing *T. excentricus*, the late Miss Procter compared it with *mucruso* believing that it could be separated by the nasals which were in contact behind the rostral and by the shape of the rostral which was truncated posteriorly instead of rounded. Both conditions occur in snakes from Kilosa and Morogoro and are not specifically important. The type had 30 midbody scale-rows and the diameter was included in the length 44 times.

In 1923, by closely following the key to the genus *Typhlops* in Boulenger's "List of the Snakes of East Africa" (1915, Proc. Zoöl. Soc. London, p. 614) I was able to split these Kilosa and Morogoro snakes into four "species" which demonstrates that the key is based on characters which are not specifically differentiating.

The reasons for referring a Morogoro snake to *T. mandensis* will be obvious from a perusal of my reasons for considering *T. mandensis* Stejneger a synonym of *T. s. mucruso*. The Morogoro snake, presumably being about to slough, showed no traces of an eye and in consequence falls into the wrong section of the key. Boulenger confirmed this identification and later, when I wrote to him from East Africa, he very kindly reëxamined the specimen and replied that he still considered it answered to the description of *mandensis*.

The name *dinga* was applied to two large snakes whose diameter into body length agreed with the large type of that species and whose dorsal coloration they closely resembled.

Measurements. These fourteen snakes measure from 135 to 860 mm. in total length with midbody diameters of from 5 to 20 mm., being contained in the total lengths from 22 to 47 times.

Summary of races.

Midbody scale-rows 32 to 42 (rarely 44); diameter included in length from 25 to 45 times; at least median line of belly immaculate. (East Africa south of the Zambesi) . . . . *T. s. schlegelii*

Midbody scale-rows 30 to 36 (rarely 38); diameter

included in length from 23 to 38 times*; at least median line of belly immaculate. (Angola, Central and East Africa north of the Zambesi except for a small area in Central Tanganyika) .... *T. s. mucruso*

Midbody scale-rows 30 to 36; diameter included in length from 22 to 47 times; belly colored like the back. (Mpwapwa to Morogoro in central Tanganyika Territory) .... *T. s. excentricus*

Typhlops opisthopachys Werner

Typhlops opisthopachys Werner, 1917, Mitt. Zoöl. Mus. Hamburg, **34**, p. 35: Tanga, Tanganyika Territory.

On first reading the description of this snake I observed that it was totally unrelated to any group of African Typhlops. After an exhaustive attempt to find any Ethiopian allies, I came to the conclusion that it was an Australian species.

I wrote to my friend Dr. Werner and asked whether he could furnish any further information as to its origin. He replied that the snake had been received from "a German engineer who indicated that he had found it at Tanga." It is now in the Hamburg Museum. I suggest that possibly the donor was an engineer on a German liner who may have forgotten in what port he obtained the snake in question.

My reasons for making such a suggestion are as follows. This Typhlops is a peculiar species of unusual proportions and yet Werner's description agrees in almost every detail with a specimen of *Typhlops pinguis* Waite (1897, Trans. Roy. Soc. South Austral., **21**, p. 25, pl. iii: South Australia) from Lake Preston, West Australia (M. C. Z. 32813).

The only points in which Werner's description differs from the Australian reptile are as follows:

Ocular above the 3rd and 4th supralabials; rostral almost as broad as the nasal, at its broadest about half the breadth of the head, at its narrowest included three and a half times in the breadth of the head .... *pinguis*

Ocular above the 3rd and 4th supraocular; rostral as broad as the nasal, included four times in the breadth of the head .... *opisthopachys*

*Undoubtedly will be extended when larger specimens are available.

As the ocular cannot be above its supraoculars, the latter is evidently a misprint for supralabials. The other differences I propose to disregard in view of the complete agreement in all other respects of these two peculiarly proportioned snakes.

Therefore I propose to consider *opisthopachys* Werner a synonym of *pinguis* Waite and remove it from the African list as has already been done with *Fanchonia elegans* Werner (gen. et sp. nov.) which was found to be based on the Australian *Hyla aurea* (Lesson).

LEPTOTYPHLOPIDAE

Leptotyphlops emini (Boulenger)

Glauconia emini Boulenger, 1890, Ann. Mag. Nat. Hist. (6), **6**, p. 91: Karagwe, Bukoba, Tanganyika Territory.

1 (M. C. Z. 30063) Kitungulu, Urungu. 15. v. 30.

Distribution. This species has been recorded by Boulenger from Nyamkolo (Niomkolo) to the south of Kitungulu.

Native name. Luminuminu (Kirungu).

Measurements. Total length 102 (94.5+7.5) mm., the diameter, which is 2 mm., is included in the length 51 times.

Habitat. Taken by digging in sandy soil beneath a log on a hillside.

Leptotyphlops longicauda (Peters)

Stenostoma longicauda Peters, 1854, Monatsb. Akad. Wiss. Berlin, p. 621, Tete, Mozambique.

Glauconia emini Loveridge (*nec.* Boulenger), 1923, Proc. Zoöl. Soc. London, p. 874: Dar es Salaam, Tanganyika Territory.

Glauconia longicauda Loveridge, 1923, Proc. Zoöl. Soc. London, p. 875: Lumbo, Mozambique; Angel, 1925, in Voyage de Ch. Alluaud et R. Jeannel en Afrique Orientale (1911–1912), p. 30: Kulumuzi, Tanga, Tanganyika Territory.

The unfortunate misidentification of a young *longicauda* as *emini* was due to placing too much reliance on the generic key in Boulenger's "List of the Snakes of East Africa." (1915, Proc. Zoöl. Soc. London, p. 616). The appearance of Angel's first record of the occurrence of *longicauda* in Tanganyika caused me to examine his snake and re-examine my Dar es Salaam specimen. As a result I suggest the following amendment to the key which should read:—

Diameter of body 45–57 times into total length; tail
8–11 times; color black.......................... *emini*

Diameter of body 57–70 times into total length; tail 8–9 times; color white (pink in life) . . . . *longicauda*

Leptotyphlops conjuncta (Jan)

Stenostoma conjuncta Jan, 1861, Arch. Zoöl. Anat. Fisiol., **1**, p. 189: South Africa.

Glauconia conjuncta Boulenger, 1893, Cat. Snakes Brit. Mus., **1**, p. 67: South Africa; Natal; Kilimanjaro, Tanganyika Territory.

Glauconia scutifrons Lönnberg (*nec.* Peters), 1907, Reptilia and Batrachia in Sjöstedt, 1910, Kilimandjaro-Meru Expedition, **1**, part 4, p. 14: Ngare na nyuki, Tanganyika Territory.

Glauconia merkeri Werner, 1909, Jahresh. Ver. Nat. Wurttemb., **65**, p. 61: Moshi, Tanganyika Territory; Loveridge, 1923, Proc. Zoöl. Soc. London p. 874: Mtali's village, Mkalama, Tanganyika Territory.

Glauconia latirostris Sternfeld, 1912, Wiss. Ergebn. Deutsch-Zentral-Afrika-Exped., **4**, p. 264: Northwest of Lake Tanganyika.

Glauconia emini Sternfeld (*nec.* Boulenger), 1912, Wiss. Ergebn. Deutsch-Zentral-Afrika-Exped., **4**, p. 264: Ukerewe Island, Tanganyika Territory.

Glauconia distanti Loveridge (*nec.* Boulenger), 1923, Proc. Zoöl. Soc. London, p. 874: Morogoro and Kilosa, Tanganyika Territory.

Leptotyphlops distanti Barbour & Loveridge (*nec.* Boulenger), 1928, Mem. Mus. Comp. Zoöl., **50**, p. 109; Loveridge, 1929, U. S. Nat. Mus. Bull. No. 151, p. 18: Morogoro and Mt. Longido, Tanganyika Territory.

1 (M. C. Z. 30064) Entebbe, Lake Victoria. 28. vi. 30.
2 (M. C. Z. 30065–6) Ukerewe Id., Lake Victoria. 10. vi. 30.

Affinities. The key referred to under the last species is still more unfortunate in making a major division based on whether the rostral shield extends backwards beyond the level of the eyes for it may or may not do so in *conjuncta* though it always does so in *distanti* (=*scutifrons*); the width of the rostral in relation to that of the head is rather difficult to define in practice. This key misled Boulenger himself in referring my first Morogoro snakes to *distanti*, a course which I have consistently followed with all East African material where the rostral did so extend. In the larger Ukerewe snake it extends further than in the smaller and this caused me to reopen the whole question; while passing through London I took the opportunity of comparing the larger Ukerewe snake with the type of *distanti* and found that though the rostral extends backwards in both snakes in a similar degree yet the Ukerewe snake had not nearly so broad a rostral as the type of *distanti*. East African records of the occurrence of *distanti* or *scutifrons* north of the Rovuma River should be referred to *conjuncta*.

When, in 1912, Sternfeld reported *L. emini* from Ukerewe Island he stated that his specimen was so dried up that he could not be certain of the identification. As my specimens from that island are undoubtedly *conjuncta* I amend his determination.

In describing *G. latirostris* in the same paper he states that it only differs from *conjuncta* in possessing a larger rostral extending beyond the level of the eyes, a character which the Ukerewe snakes show to be variable with age.

Through the exceeding kindness of Dr. Wilhelm Götz of the Wurttemburg Naturaliensammlung, Stuttgart, I have been able to examine the two cotypes of Werner's *Glauconia merkeri* from Moshi at the foot of Kilimanjaro. Having carefully measured and remeasured these specimens several times I find that Werner was in error in his measurements. Actually the 160 mm. snake even when stretched is only 150 mm., and the 175 mm. specimen only 172 mm., the diameter of both is approximately the same, 2.75 mm., resulting in the diameter being included in the total length only 54–62 times instead of 80–87 times as reported; the tails are included in the length 10.7 to 13.2 times. Nor can I agree that the rostral is "at least twice as broad as the nasal," I should say that it is not quite twice as broad. The posterior edge of the rostral is about level, or slightly beyond, an imaginary line connecting the posterior borders of the eyes but as I have stated above this condition is common in *L. conjuncta* of which I consider *L. merkeri* a synonym.

Having reached these conclusions I communicated with Mr. V. FitzSimons regarding the status of *distanti* of which they possess a good series of topotypic (Pretoria, Transvaal) material in the Transvaal Museum. Under date of January 29, 1931 he replied, ". . . I have found extreme difficulty in separating *scutifrons* and *distanti*. I have gone very carefully over our series and cannot find any distinctive characters on which to separate them. The average proportions of diameter of body and of length of tail, into total length, work out about the same, while the rostral varies so much in shape and size that it cannot be used as a satisfactory character. I have, however, one specimen in which the rostral covers practically the whole head, but owing to its bad state of preservation little else is distinguishable. This may be *distanti,* but until I can obtain further material I am regarding *distanti* as a synonym of *scutifrons*."

The series of *scutifrons* in the collection of the Museum of Comparative Zoölogy were likewise inseparable from a pair of snakes from Pretoria received as *distanti* so that I believe we are justified in con-

sidering *distanti* a synonym of *scutifrons* which was described from Sena, Mozambique.

My final conclusion is that *conjuncta* and *scutifrons* may be most readily separated by the width of the rostral in its relation to the nasal, thus:—

Rostral at least three times the width of the nasal; diameter of body 42 to 68 times into the total length....... *scutifrons*

Rostral not more than twice the width of the nasal; diameter of body 32 to 72* times into the total length...... *conjuncta*

Measurements. The larger Ukerewe snake, a male, measures 142 (130+12) mm., the smaller 74 mm. Diameters are 2 and 1.5 mm. and are included in the total length 71 and 49 times respectively.

Enemies. The Entebbe snake was recovered from the stomach of a young burrowing viper (*Atractaspis irregularis*) and the head being digested away the identification is based on an Entebbe specimen of *conjuncta* in the British Museum.

BOIDAE

Python sebae (Gmelin)

Coluber sebae Gmelin, 1788, Syst. Nat., **1**, p. 1118: No type locality.
Python sebae Boulenger, 1893, Cat. Snakes Brit. Mus., **1**, p. 86.

Skulls and skin (M. C. Z. 30067–9) Ukerewe Id., Lake Victoria. 16. vi. 30.

Measurements. With a view to obtaining data which might prove of assistance in estimating the actual length of a snake whose dried skin only is available, I measured one of these snakes in the flesh and found it to be 2,180 mm., while its dried, and not unduly stretched, skin measured no less than 2,650 mm. That is to say an increase of at least .21 of the total length should be allowed for, or in other words a dried skin is nearly a quarter as long again as was the living reptile from which it was taken. The skull of this same snake measures 84 mm. in its greatest length so that it may be assumed that a python is about twenty-six times longer than its skull though this proportion varies with age for the larger snake measured 4,330 mm. in the flesh with a skull length of only 128 mm. or a thirty-third of its total length.

Diet, folklore etc. Ukerewe Island is somewhat famous for its big pythons; the large dimensions which they reach may be attributed to the beliefs of the Wakerewe who object to the killing of these snakes

*32 times in a bloated female from Wakkerstroom, Transvaal, though other snakes from the same locality are from 40–60 times. 72 times in a snake from Mt. Longido.

for they hold that death or misfortune will befall the slayer or his relatives as a consequence of his action.

A few months prior to my arrival on Ukerewe, Mr. W. E. H. Scupham, District Officer of Mwanza, had visited the island and shot a python there. He had planned to return to Mwanza the same evening but the engine of his motor launch broke down and, having neither oars nor sail, he and his men drifted about all night till the currents brought them back to Ukerewe Island in the morning. "There you are," said Chief Gabriel, "that comes of your killing this python." A few weeks later a further communication from Gabriel reported that a python had caught and killed a woman on the island. I was asked by Scupham to investigate this report. Curiously enough on the very evening of my arrival at Murutunguru, Père Conrads of the Catholic Mission of Marienhof, himself a well-known naturalist, showed me the head of this snake and communicated to me the details of how it had killed the woman.

The woman had been engaged in washing clothes beside a stream and spreading them out upon the ground nearby. She was not very well at the time having, only eight days previously, given birth to a baby which had died. A native coming to the ford observed the clothes spread about but no sign of the owner; he called but received no reply. Thinking this strange he began a search in the vicinity and came upon the woman lying dead in the coils of a huge python. Returning to the village he summoned the men who, overcoming their usual reluctance, killed the reptile with four spear thrusts and two knifings. The snake was measured and found to be four and a half metres, with a midbody diameter of forty centimetres.

The natives stated that thirty years ago a youth or big boy (*kijana kubwa*) was killed by a python on the island. This is the only fatal case in the recollection of the old men who said that though many persons have been caught by pythons they invariably escape by exerting their strength. An educated Mkerewe told me that so great was the aversion to killing a python that should one of his fellow tribesmen find his own child dead in the coils of one of these snakes he would not kill the snake for he would argue, "The child is dead anyway, why should I die also for killing the reptile." Tangible evidence of their dread of dead pythons was observed when the specimen listed above was being skinned by the side of the mainroad; several natives were seen to retrace their steps on catching sight of it afar off and then they made an extensive detour rather than pass within a hundred feet of the remains.

On Thursday evening, June 12, 1930, the village headman told me that two natives had seen a big python out in the bush. On my enquiring why they had not come and reported the fact to me at once, he replied that they feared I would shoot and skin it, in which case some calamity might befall them. I told him to inform them that I promised not to shoot it, nor even to hit it but would take it alive. Next day I was returning to camp for lunch at 4 p.m. when I was told that the natives had been back to the place where they had seen the python and found it still in the same spot; they had come to report this to me but had grown tired of waiting as I was so long absent! I sent for them but only one appeared; first of all he asked if it was true that I promised not to kill it and on being assured that this was the case he next inquired what I would give him for revealing the whereabouts of the snake, which I was assured was quite close. Forgetting for the moment that there were two men to be compensated I replied, "Fifty cents." (being equivalent to 12c in U. S. currency or 6d in English coinage). He murmured something and I continued my meal. When I had finished and enquired for the man, it was said that he had gone off saying that fifty cents was insufficient, he would catch the snake himself, perhaps, and sell it to me. I replied that I was quite willing to do this but if he hit it with a stick I should refuse to buy it as I wanted it alive and well. The tiresome business was eventually concluded by the man's return and my fresh offer of fifty cents to each of them. This was entirely satisfactory; the missing companion was immediately forthcoming and we set out at 5 p.m. armed with a T-shaped stick, a small sack eighteen inches square and, as I had nothing else available, my duffle bag in which to put the python when captured.

Instead of being "nearby," as stated, we had to walk a mile and a half through the bush before we reached the place, and when we got there the python was gone! It had been lying in a dense thicket overgrown with rank grass taller than a man, the spot where it had been was plain enough for the grass was flattened where it had lain. The thicket covered an area of about thirty feet by twenty feet and there were many similar thickets in the immediate vicinity.

Pushing into the thicket I found that the snake had only moved some six feet further in for I caught sight of its coils which were enormous, at midbody the girth was greater than that of an average man. I proceeded to beat down the grass and brambles till one had a clear view and while I was so engaged the reptile struck at me open-jawed, his head going as high as my chest and once as high as my

throat. Having cleared the arena, I hung the small sack on the end of the snake stick and let the snake strike the sacking half-a-dozen times; each time it struck, the sack would fall to the ground only to be lifted again on the end of the stick. While I was engaged in recovering it the snake struck too quickly a couple of times and to avoid the blow I had to step back so that the force of it was spent in space; the snake flopped down but quickly withdrew its head on the defensive again. After a dozen futile attempts in one of which it struck the end of my snake stick through the sack—and the blow had the force of a sledge hammer—the python became discouraged and decided to retire. As it commenced to glide away I sprang after it, planted the T-end of my stick on its neck for a second as I grasped it firmly with my hand before it had time to throw off the stick. Salimu, who had been standing by waiting for orders, now came running to seize its tail; Abedi grasped it round the middle and a temporary employee held open my duffle bag crying continuously in the vernacular, "It cannot go, it won't go in." Thrusting the snake's head to the bottom of the bag I seized the neck again from the outside, i.e. through the material. Before going in, however, it dribbled from both ends, trying, I think, to disgorge the bushbuck which it had swallowed, the result was the most appalling stench imaginable. It would have made most people sick but at the moment we had other things to think about! We just crammed and crammed that poor old python into the bag and after we succeeded in doing this it was all we could do to lace up the opening with some cord which I had brought for the purpose.

By this time it was nearly dusk and as I had much to attend to in camp, I gave orders to cut two poles (and the boys had only one jack-knife among them with which to accomplish this) and so convey the duffle-bag to camp. As soon as the poles were ready the two guides refused to carry the snake on superstitious grounds. I had left supposing that they would lend a hand. It was impossible for my three boys to carry the two poles, so they did what seemed to them the next best thing and slung the bag from a single pole. Unfortunately they wound the bark-cord round and round the middle of the bag at one spot. In this way they carried it for about a mile until both Abedi's shoulders were raw, then they gave up and sent one of their number on to camp for help. When they at last reached camp with their load it was after dark, and we immediately placed the bag on the mission scales, Père Conrads supervised the weighing and found the python scaled sixty kilos (135 lbs.). Then I emptied the bag on to a comfortable bed of straw in a large packing case, nailed down the lid, put a

fifty kilo weight on top of the lid, and left it for the night about twenty feet from my camp bed but where I could see it in the moonlight from where I lay.

During the night a Spotted Hyena approached very near but scared by my moving, decamped and did not return, it had evidently got a whiff of my captive. Purposely I left the snake for a few days to digest its meal intending to pack it carefully on the third day as I was leaving Ukerewe Island on the fourth. When the third day arrived and I opened the box it was to find the python dead and already so far gone in decomposition that only the skull was worth saving. We stretched it out, however, and found that it measured fourteen feet, four inches (4,330 mm.) in length, while the diameter at midbody was one and a half feet (440 mm.), the actual circumference being three feet, three and a half inches (1,000 mm.), nor was this astonishing size due to inflation resulting from decomposition for dissection revealed a fully adult bushbuck doe in milk, if not in young. The reason for the python's death was obvious, the rhythmic jerk-jerk to which the bag had been subjected as the boys staggered along with it had caused the snake to be strangulated by the cord wound round the middle of the bag which threw all the weight on one spot.

At noon on June 18th an Mkerewe came to tell me that a python which had taken one of his goats some weeks before had just been located near his village. It was two miles to the place; when we got there, after a trying walk in the midday heat and glare, the snake was found lying more or less extended, part of its length being concealed in a bush. It was captured without the least difficulty; its length was approximately ten feet yet it weighed thirty-eight kilos when boxed, probably thirty kilos or sixty-five pounds net. It was boxed at Mwanza and dispatched on June 23rd by rail to Dar es Salaam. On July 10th I opened the box on board the *S.S. Usambara* and found that the snake had made no evacuation but it did so as soon as I lifted it from the box. I transferred it to a tub of fresh water, covered the tub with a sack, and left it to soak for an hour before returning it to its box. A week later I again removed it for an hour's soaking and found that it had sloughed and was resplendent with a beautiful bloom on its scales. The box was shallow, about a foot in depth, and was lined with sacking which was padded on sides and bottom with excelsior, the lid was a series of slats but the interspaces protected by sacking. In this receptacle the snake travelled to London arriving in excellent condition, being presented to the London Zoölogical Society (which had defrayed all expenses) by the Museum of Comparative Zoölogy.

COLUBRIDAE

NATRIX OLIVACEUS (Peters)

Coronella olivacea Peters, 1854, Monatsb. Akad. Wiss. Berlin, p. 622: Tete, Mozambique.

3 (M. C. Z. 30070–2) Mwaya, Lake Nyasa. 1–8. iii. 30.
1 (M. C. Z. 30073) Nkuka Forest, Rungwe Mtn. iii. 30.
1 (M. C. Z. 30074) Albertville, Lake Tanganyika. 21. v. 30.
1 (M. C. Z. 30075) Ukerewe Id., Lake Victoria. 19. vi. 30.

Native name. *Injalalu* (Kinyakusa).

Variation. The mountain snake, as might be expected, had 17–17–15 scale-rows, the Albertville, unexpectedly, 17–17–17, the Ukerewe Island reptile 17–19–17 while the three Mwaya specimens were normal in possessing 19–19–17, the foremost row in these might be 21 if counted almost on the back of the head.

Ventrals ranged from 131–142; anals divided; subcaudals 53–63 but only those of three snakes were countable the others having lost the ends of their tails; the subcaudal range of forty Uluguru and Usambara snakes was 63–87.

Coloration. The Rungwe Mountain snake agreed with Uluguru and Usambara specimens in having the edges of the ventrals plum-colored or reddish-mauve while the central area was bright orange. Both the Albertville and Ukerewe snakes possessed a vertebral stripe of chocolate brown, agreeing in this respect with the series from Stanleyville, Belgian Congo in the collection of the American Museum of Natural History but differing from all other East African *olivaceus* which I have seen.

Measurements. All are of small size, the largest snake being 460 (360+100) mm., the smallest 206 (161+45) mm.; both are from Mwaya.

Diet. The stomach contents of a Mwaya snake consisted of a frog (*Arthroleptis minutus*).

Enemies. Three of the series have lost their tails, this is 50% of the total therefore rather higher than in mountain snakes.

Habitat. One day, being caught in a heavy downpour while on the flats near Mwaya, we sought refuge in a small hut at the edge of a rice field. The hut, which was used only when the rice was ripening, was in a very delapidated state and its floor strewn with grass. More than a score of natives gathered in this hut for shelter when suddenly an uproar arose—a native had found himself sitting upon a couple of

snakes! One of these escaped me, the other I secured and it proved to be an Olive Water Snake. The Albertville snake was taken under a bundle of thatching grass lying beside a half-finished hut which was also situated in a swampy flat.

GLYPHOLYCUS BICOLOR Günther

Glypholycus bicolor Günther, 1893, Proc. Zoöl. Soc. London, p. 629: Lake Tanganyika.

Herophidion hypsirhinoides Werner, 1924, Sitzb. Ak. Wiss. Wien, **133**, p. 53: "? New Guinea."

1 (M. C. Z. 30076) Sumbwa, Lake Tanganyika. 20. v. 30.

Variation. Agrees in every detail with the description of the type series; it has been compared with a topotype received in exchange from the British Museum.

Measurements. A male, measuring 481 (365+116) mm.

Habitat. This specimen was found freshly-dead, washed up on a sandbar of the Lake shore. Local natives stated that *Glypholycus*, like *Boulengerina*, only occurs on the rock-bound coasts but that there was such a rocky foreshore a few miles from Sumbwa where *Glypholycus* was plentiful.

BOAEDON LINEATUS Duméril & Bibron

Boaedon lineatus Duméril & Bibron, 1854, Erpét. Gén., **7**, p. 363: Gold Coast.

1 (M. C. Z. 30078) Bagamoyo. 16. xi. 29.
1 (M. C. Z. 30079) Unyanganyi, Turu. 4. xii. 29.
1 (M. C. Z. 30080) Dabaga, Uzungwe Mtns. 1. i. 30.
1 (M. C. Z. 30077) Madehani, Ukinga Mtns. 14. ii. 30.
11 (M. C. Z. 30081–91) Mwaya, Lake Nyasa. 1–8. iii. 30.
1 (M. C. Z. 30092) Tukuyu, Rungwe. 13. iii. 30.
3 (M. C. Z. 30093–5) Ilolo, Rungwe. 31. iii. 30.
1 (M. C. Z. 30096) Igale, Poroto Mtns. 30. iv. 30.
1 (M. C. Z. 30097) Nyamkolo, Lake Tanganyika. 9. v. 30.
1 (M. C. Z. 30098) Ujiji, Lake Tanganyika. 28. v. 30.
1 (M. C. Z. 30099) Mwanza, Lake Victoria. 6. vi. 30.
1 (M. C. Z. 30100) Ukerewe Id., Lake Victoria. 19. vi. 30.
1 (M. C. Z. 30101) Entebbe, Uganda. 27. vi. 30.
1 (M. C. Z. 30102–3) Kampala, Uganda. vi. 30.

Distribution. The Brown House Snake has been recorded from Mpwapwa and Bukoba, as well as Uhehe and Ukerewe Island, by Sternfeld.

Native names. Melawuletzi (Kikinga); *injoka* (Kinyakusa, but not specific).

Variation. Midbody scale-rows 27–31; ventrals 194–231 (males 194–207, females 210–231); anal single; subcaudals 41–67 (males 61–67, females 41–53); labials 8, the 4th and 5th entering the orbit excepting for Nos. 30077–8 where it is the 3rd, 4th and 5th; preoculars 2 except for Nos. 30077, 30079 and 30093 where there is only a single preocular so that Parker (1930, Ann. Mag. Nat. Hist. (10), **6**, p. 598) is incorrect in stating that a single preocular is normal for this species, at least so far as East African snakes are concerned; the upper preocular is in contact with the frontal in thirteen specimens, on one side of the head only in two, and separated from the frontal in eleven.

Measurements. The largest snake measures 681 (560+121) mm. and is from Mwaya; the biggest female is 970 (860+110) mm. and was taken at Ilolo; the smallest snake, also from Mwaya, measures 255 (221+34) mm.

Sex. The proportion of males to females is ten to fifteen.

Diet. Stomach contents consisted of rodents as follows: (1) *Arvicanthis abyssinicus muanzae* at Mwanza, (2) *Cryptomys hottentotus whytei* at Ilolo, and other unidentified rodents in Ilolo, Mwaya and Madehani snakes.

Parasites. A tick was removed from the throat of the Nyamkolo snake; nematode worms (*Kalicephalus* sp.) were found in its stomach and also in the stomach of an Unyanganyi reptile which had in addition an undescribed species of Arduenna.

Enemies. One Brown House Snake, found dead on the road, presumably killed by a car, was put into a cage containing three young Banded Mungoose (*Mungos mungo colonus*) which immediately attacked and devoured all of it except the head and backbone.

Lycophidion capense capense (Smith)

Lycodon capense A. Smith, 1831, S. Africa Quart. Journ., (1) No. 5, p. 18: Kurrichane, i.e. Rustenberg district, Transvaal.

4 (M. C. Z. 30109–12) Mwaya, Lake Nyasa. 1–8. iii. 30.
1 (M. C. Z. 30113) Ujiji, Lake Tanganyika. 28. v. 30.
1 (M. C. Z. 30114) Ukerewe Id., Lake Victoria. 10. vi. 30.
1 (M. C. Z. 30115) Kampala, Uganda. vi. 30.
1 (M. C. Z. 30116) Jinja, Uganda. 30. vi. 30.

Distribution. The Cape Wolf Snake has been recorded by Sternfeld as occurring at Bagamoyo, Dar es Salaam and Ukerewe Island; while

he lists another from Entebbe but under the name of *L. jacksoni* which is a synonym. Roux reports it from Bukoba.

Native name. *Mwanyaluloshа* (Kinyakusa).

Variation. Midbody scale-rows 17; ventrals 174–211 (extremes from Kampala and Mwaya); subcaudals 29–48 (Jinja and Mwaya); labials 8, the 3rd, 4th and 5th entering the orbit with the exception of the Ukerewe Island snake which has only 7 labials of which the 3rd and 4th enter the orbit, 6th largest. Some might wish to refer it to the West African *fasciatum* but it is undoubtedly an aberrant *capense*.

Coloration. All the above agree in having the throat more or less white, which is also the case with twenty-two other specimens in the Museum of Comparative Zoölogy from Kenya, the Usambara and Uluguru Mountains, Rhodesia, the Transvaal, Cape Colony and Southwest Africa, this in contrast with *L. c. acutirostre*.

Measurements. The largest male measures 507 (352+155) mm., and the largest female 497 (445+52) mm., both from Mwaya.

Lycophidion intermediates between capense and acutirostre Günther

? *Lycophidium acutirostre* Boettger in Voeltzkow, 1913, Reise in Ostafrika, **3**, pt. 4, p. 363: Mavene, near Tanga, Tanganyika Territory. Sternfeld, 1912, Wiss. Ergebn. Deutsch-Zentral-Afrika Exped., **4**, p. 268: Kenya Colony.

5 (M. C. Z. 30104–8) Bagamoyo. 11–12. xi. 29.

also the following material:—

1 (M. C. Z. 5992) Zanzibar.
1 (M. C. Z. 18191) Kilosa, Tanganyika Territory.
1 (M. C. Z. 18192) Morogoro, Tanganyika Territory.

Variation. Midbody scale-rows 17; ventrals 158–169; subcaudals 27–42; if the Bagamoyo series be taken alone the ventrals range is 158–169 and the subcaudals 27–33.

With the exception of a single snake taken by Sir John Kirk shortly after he secured the type series of four, no additional specimens of *L. acutirostre* Günther have been recorded from that island so far as I am aware. Sternfeld has considered a snake from Kenya Colony with 159 ventrals and 33 subcaudals referable to this species. The five Zanzibar snakes, however, ranged from 140–150 in number of ventrals and 18–28 in subcaudals, a sixth snake from Zanzibar with 179 ventrals and 45 subcaudals was referred to *L. capense* by Boulenger in 1893.

In 1915 Boulenger records the recognized scale-counts as

L. capense	163–208 ventrals and	24–47 subcaudals	
L. acutirostre	140–150 " "	18–28	"

from which it will be seen that the present series are intermediate though in the dark coloring of their throats they agree with *acutirostre*.

It seems probable, therefore, that *acutirostre* represents the extreme of variation in the extreme east (Zanzibar) of the extensive range of *capense* and that occasional Zanzibar snakes, as well as those from Bagamoyo, Morogoro and Kilosa must be regarded as intermediates. It might be added that the Morogoro-Kilosa fauna is essentially that of the coastal belt.

Coloration. All the above agree in having the throat and lower surface uniformly blackish-brown.

Measurements. The largest Bagamoyo snake measures 344 (320+24) mm.

Diet. The following skinks were recovered from three Bagamoyo snakes:—(1) *Riopa s. sundevallii*, (2) *Ablepharus wahlbergii*, (3) four tails of *A. wahlbergii*, the latter is of interest as showing the preservation value of a readily fractured tail!

Parasites. Both nematodes and tapeworms (*Oochoristica sp.*) were recovered from these snakes.

LYCOPHIDION CAPENSE UZUNGWENSIS Loveridge

Lycophidion capense uzungwensis Loveridge, 1932, Bull. Mus. Comp. Zoöl. **72**, p. 375: Dabaga, Uzungwe Mtns., Tanganyika Territory.

♂ (M. C. Z. 30117) Dabaga, Uzungwe Mtns. 1. i. 30.
♀ (M. C. Z. 30118) Kigogo, Uzungwe Mtns. 23. i. 30.

Distribution. As the localities from which these snakes came are in the far north and extreme south of the Uzungwe range this race should occur throughout the mountains. I heard of a third specimen from a German lady who, on learning that I was collecting snakes, asked if I "had ever seen a black snake with a bright red arrow-like marking on its head?" She added that she had seen one in these mountains and was struck by its unusual appearance.

Diet. The female held a skink (*Mabuya varia varia*) in her stomach.

PSEUDASPIS CANA (Linnaeus)

Coluber canus Linnaeus, 1758, Syst. Nat., ed. 10, **1**, p. 221: "Indiis."

1 (M. C. Z. 30119) Lukungu, Ubena Mtns. 8. ii. 30.
1 (M. C. Z. 30120) Mangoto, Ukinga Mtns. 10. ii. 30.

Native name. Ketumba (Kikinga).

Variation. Both normal in possessing 25 midbody scale-rows; 192–200 ventrals; divided anals and 56–46 subcaudals.

Measurements. Both are young, the Lukungu snake, presumably a male with fewer ventrals and more caudals, measures 297 (250+47) mm., and the Mangoto female 290 (255+35) mm.

Habitat. I captured the Lukungu snake in a marshy valley at an altitude of about 6,000 feet.

Chlorophis emini (Günther)

Ahaetulla emini Günther, 1888, Ann. Mag. Nat. Hist. (6), **1**, p. 325: Monbuttu, Belgian Congo.

1 (M. C. Z. 30121) Mwaya, Lake Nyasa. 1–8. iii. 30.

Distribution. This record considerably extends the known range for the most southerly known to me are those of Roux and Sternfeld for Bukoba.

Native name. Imbindipindi (Kinyakusa for green tree snakes).

Variation. Midbody scale-rows 15; ventrals 158; subcaudals 103; 9 labials, the 4th, 5th and 6th entering the eye. It only differs from the type in having 103 instead of 111 subcaudals and in possessing two preoculars.

Measurements. Total length 800 (550+250) mm.

Chlorophis hoplogaster (Günther)

Ahaetulla hoplogaster Günther, 1863, Ann. Mag. Nat. Hist. (3), **11**, p. 284: Port Natal, i.e. Durban, South Africa.

1 (M. C. Z. 30122) Bagamoyo. 18. xi. 29.
3 (M. C. Z. 30123–5) Mwaya, Lake Nyasa. 1–8. iii. 30.
5 (M. C. Z. 30126–30) Ilolo, Rungwe. 15–30. iii. 30.
1 (M. C. Z. 30131) Ukerewe Id., Lake Victoria. 16. vi. 30.

Distribution. Sternfeld has recorded *hoplogaster* from Kitopeni; Bagamoyo; Tukuyu and Bukoba, and Boulenger from Victoria Nyanza.

Native name. Imbindipindi (Kinyakusa for green tree snakes).

Variation. Midbody scale-rows 15; ventrals 141–160; subcaudals 82–95; labials 8, the 4th and 5th entering the eye except on the right side of No. 30129 where the 4th, 5th and 6th enter. The Ilolo snakes with from 141–150 ventrals are lower than the others which are 150

for all three Mwaya snakes, 155 for Bagamoyo and 160 for Ukerewe Island; the range for the species as recognized hitherto was 150–169. Number 30125 and the Ilolo series are intermediate between *hoplogaster* and *neglectus* for the former have definite, even if slight, traces of ventral keels while of the latter three are quite smooth, one has scattered traces of keeling on the ventrals and two more pronounced keeling. I have noted a similar intermediate condition in a Kenya snake (U.S.N.M. 49012) which leads me to suspect that *neglectus* is more entitled to be regarded as a race of *hoplogaster* than as a full species.

Coloration. One Ilolo snake had the neck mottled pale blue and brown, another, said to have been taken within the Nkuka Forest boundaries, possessed paired blue spots on either side of the middorsal area on the anterior third of the back as was the case with snakes referred to *neglectus* from the rain forest of the Uluguru Mountains.

Measurements. The Ukerewe Island snake measures 712 (500+212) mm., all the series from the southwest are small, the largest is only 550 (380+170) mm.

Breeding. Five ova, measuring 28 x 8 mm., were taken from a Mwaya snake on March 3; the large Ukerewe snake held only two eggs measuring 29 x 8 mm. on July 16, 1930.

Diet. A gecko (*Hemidactylus persimilis*) was recovered from a Bagamoyo snake and a frog (*Arthroleptis whytii*) from an Ilolo reptile.

CHLOROPHIS NEGLECTUS (Peters)

Philothamnus neglectus Peters, 1866, Monatsb. Akad. Wiss. Berlin, p. 890: Prazo Boror, Mozambique.

♂ (M. C. Z. 30132) Kigogo, Uzungwe Mtns. 23. i. 30.

Distribution. Already recorded from Uhehe by Sternfeld.

Native name. *Nyaluwina* (Kihehe).

Variation. Midbody scale-rows 15; ventrals definitely with lateral keels 145; subcaudals 88; labials 8, the 4th and 5th entering the eye.

Measurements. Total length 513 (360+153) mm.

Diet. A frog (*Arthroleptis reichei*) in its stomach.

PHILOTHAMNUS SEMIVARIEGATUS SEMIVARIEGATUS Smith

Philothamnus semivariegatus A. Smith, 1849, Illus. Zoöl. S. Afr. **3**, pls. 59, 60, and 64: Bushman's Flats and Kurrichane, S. Africa.

4 (M. C. Z. 30133–6) Bagamoyo. 14–16. xi. 29.
1 (M. C. Z. 30137) Mangasini, Usandawi. 14. xii. 29.
1 (M. C. Z. 30138) Kigogo, Uzungwe Mtns. 30. i. 30.
1 (M. C. Z. 30157) Kipili, Lake Tanganyika. 19. v. 30.
2 (M. C. Z. 30158–9) Ukerewe Id., Lake Victoria. 14. vi. 30.

Distribution. Previously recorded by Sternfeld from the Zanzibar coast, Dunda in Kingani, Ukerewe Island etc.

Native names. *Mlaluwe* (Kihehe); *namafwa* (Kifipa).

Variation. Midbody scale-rows 15; ventrals 172–198; anal divided; subcaudals 134–156; labials 9–12 (10 on one side of No. 30157 and 12 on one side of No. 30159) with the 4th, 5th and 6th entering the eye except in the Kigogo snake which has the 5th and 6th only and Nos. 30157 and 30159 which have the 5th, 6th and 7th on the left side of the head only; temporals only uniform on both sides of the head in four snakes, treating the sides separately therefore fourteen show 2+2, three 2+1 and one only 1+2.

Measurements. The largest snake is a male (No. 30137) measuring 1205 (800+405) mm., the biggest female (No. 30138) being 1175 (790+385) mm.; all are of large size.

Diet. Bagamoyo snakes held (1) *Hemidactylus mabouia*, (2) *H. persimilis*, (3) Indeterminate gecko remains, (4) *Ablepharus wahlbergii*. An Ukerewe snake had swallowed two geckos (*Lygodactylus picturatus var.*).

Philothamnus semivariegatus dorsalis (Bocage)

Leptophis dorsalis Bocage, 1866, Jorn. Sci. Lisboa, **1**, p. 69: Duque de Braganca and Molembo, Angola.
Philothamnus dorsalis Schmidt, 1923, Bull. Am. Mus. Nat. Hist., **49**, p. 78: Banana, Lower Congo.

22 (M. C. Z. 30139–56) Mwaya, Lake Nyasa. 1–8. iii. 30.

Distribution. Hitherto considered Angolan and Lower Congo in range, this form has not been recorded previously from Tanganyika Territory but the record is not incompatible with the known occurrence of other Angolan vertebrates in the area south of Lake Tanganyika and east of Lake Nyasa. Schmidt not unnaturally assumes that Tornier's record of this species from "Lubwa's Usoga" in "Der Kriechthiere Deutsch-Ost-Afrikas" is a Tanganyika record but Fort Lubwa is on the east bank of the Nile in Usoga, Uganda. "Lubwa's" presumably means "Chief Lubwa's village."

Native name. *Imbindipindi* (Kinyakusa for green snakes).

Variation. It should be remarked that these snakes agree with *semivariegatus* in coloring for they lack the brown vertebral line possessed by Angolan *dorsalis.* At the same time their lepidosis agrees with *dorsalis* rather than *semivariegatus.*

Midbody scale-rows 15; ventrals 167–179; anal divided; subcaudals 134–156; labials 8–10 (only 8 in two specimens and 10 in one) usually the 4th, 5th and 6th entering the eye but as the condition is azygous in six snakes a summary shows that four sides have the 4th and 5th entering, twenty the 4th, 5th and 6th, eighteen the 5th and 6th; one snake with a damaged head is omitted from this count.

P. semivariegatus has been differentiated from *P. dorsalis* as usually having 2+2 temporals though 2+1, 1+2 and even 1+1 occur very occasionally. *P. dorsalis* on the other hand has 1+1 or rarely 1+2, all other scale counts are within the range of *P. semivariegatus.* This Mwaya series is rich in intermediates, in fact only twelve of the twenty-one snakes have a uniform arrangement of temporals on both sides of the head. Treating them separately, therefore, it is seen that:

28 sides have 1+1 temporals
11 " " 1+2 "
3 " " 2+2 "

No. 30147 is the only snake with 2+2 on both sides of its head and should, perhaps, be called *P. s. semivariegatus.* In these circumstances it seems advisable to treat *dorsalis* as a race of the older form. Boulenger has recorded a single *P. semivariegatus* from the heart of Angola.

Measurements. The largest snake (No. 30151) measures 965 (610+355) mm., the smallest 421 (275+146) mm.

Diet. A tree frog (*Megalixalus fornasinii*) was the only identifiable food found in the stomachs of these arboreal snakes.

Hapsidophrys lineata Fischer

Hapsidophrys lineatus Fischer, 1856, Abh. Natur. Ver. Hamburg, **3**, p. 111, pl. 2, fig. 5: Elmine, West Africa, i.e. Elmina, Gold Coast; Sternfeld, 1912, Wiss. Ergebn. Deutsch-Zentral-Afrika Exped., **4**, p. 270; Kindu, Belgian Ruanda.

Gastropyxis orientalis Werner, 1909, Stuttgart Jahresh Ver. Natk. Wurttemb., **65**, p. 56: German East Africa.

Hapsidophrys lineata Loveridge, 1929, U. S. Nat. Mus. Bull. 151, p. 24: Kisumu, Kenya Colony.

For some years, I have been hoping for the opportunity of examining the type of *G. orientalis* which Dr. Werner informed me was in the

Stuttgart Natural History Museum but which the Director of that Institution tells me cannot be found. The type constituted the only example of the genus *Gastropyxis* found in Tanganyika Territory or Kenya Colony and its description coincides so exactly with that of *H. lineata* that I have little compunction in assuming that its author inadvertently referred it to the wrong genus.

Hapsidophrys and *Gastropyxis* are distinguished in Boulenger's key solely by the absence of keels and notches on the subcaudals in *Hapsidophrys*, these being present in *Gastropyxis;* though this difference is plain enough when specimens are contrasted the subcaudals of *Hapsidophrys* are so angular (though not notched) that it is very easy to assume that they are keeled, in fact it was through finding some *Hapsidophrys* mislabelled *Gastropyxis* in a collection that lead me to suspect the affinities of *orientalis*. I might add that the maxillary teeth are more numerous in *Hapsidophrys* than in *Gastropyxis*.

Coronella semiornata Peters

Coronella semiornata Peters, 1854, Monatsb. Akad. Wiss. Berlin, p. 622: Tete, Mozambique.

♂ (M. C. Z. 30160) Mangasini, Usandawi. 16. xii. 29.

Distribution. Sternfeld has already recorded the Semiornate Smooth Snake from Mbugwe to the northeast of Mangasini, and I have listed two from Kipetu to the southwest.

Variation. In all respects normal; midbody scale-rows 21; ventrals 186; anal divided; tail-tip missing; labials 8, the 4th and 5th entering the eye.

Diet. Its stomach held a skink (*Riopa sundevallii modestum*).

Grayia tholloni Mocquard

Grayia tholloni Mocquard, 1897, Bull. Soc. Philom. Paris, (8) **9**, p. 11: French Congo; Boulenger, 1909, Proc. Zoöl. Soc. London, p. 951, fig.

♀ (M. C. Z. 30161) Ukerewe Id., Lake Victoria. 11. vi. 30.

Distribution. Boulenger has recorded this snake from Entebbe and my collectors have previously taken it at Bukoba; the type of *G. fasciata* Boulenger, which the author subsequently relegated to the synonymy of *tholloni*, came from southwest Lake Tanganyika.

When wading in grass-grown marshes fringing Lake Tanganyika at Nyamkolo, several times I disturbed snakes which darted through

the weeds and water with great speed. I failed to secure any but concluded that they were *G. tholloni*.

Variation. This specimen agrees with Boulenger's revised description except that the temporals are 2+2, instead of 2+3, and the lower anterior temporal *is longer* than its distance from the frontal. Midbody scale-rows 15; ventrals 141; anal divided; tail-tip missing; labials 8, the 4th and 5th entering the eye.

Breeding. This semiaquatic snake, though 510 mm. in length from snout to vent, held only three eggs; these measured 25 x 16 mm., and were developing, possibly indicating that the species is viviparous.

Diet. The stomach held the hind legs of a large frog (*Rana ? mascareniensis*).

Parasites. Worms (*Kalicephalus sp.* and *Thubunea sp. n.*) were also recovered from its stomach.

DUBERRIA LUTRIX SHIRANUM (Boulenger)

Homalosoma shiranum Boulenger, 1894, Cat. Snakes Brit. Mus., **2**, p. 276, pl. 13, fig. 1: Shiré Highlands, Nyasaland.

H. lutrix var. *atriventris* Sternfeld, 1912, Wiss. Ergebn. Deutsch-Zentral-Afrika-Exped., **4**, p. 271: Kissenje, Belgian Ruanda.

4 (M. C. Z. 30162–5) Dabaga, Uzungwe Mtns. 1. i. 30.
1 (M. C. Z. 30166) Ihanganya, Uzungwe Mtns. 6. i. 30.
16 (M. C. Z. 30167–82) Kigogo, Uzungwe Mtns. 13–30. i. 30.
4 (M. C. Z. 30183–6) Mangoto, Ubena Mtns. 10. ii. 30.
2 (M. C. Z. 30187) Tandala, Ukinga Mtns. 11. ii. 30.
9 (M. C. Z. 30188–96) Madehani, Ukinga Mtns. 14–28 ii. 30.
6 (M. C. Z. 30197–202) Ilolo, Rungwe. 28. iii. 30.

Native names. *Nyaluhereka* (Kikinga); *isakani* (Kinyakusa). Both the Wakinga and Banyakusa, however, consider this small snake is the young of *Trimerorbinus tritaeniatus* to which they apply the same names.

Affinities. *H. shiranum* has paragraph priority over *H. abyssinicum* of the same author who referred both to the synonymy of *H. lutrix* (Linnaeus) a few years later. The type locality of *lutrix* is given as "Indiis," in all probability it came from the Cape of Good Hope.

As there are only ten examples of typical *lutrix* in the Museum of Comparative Zoölogy I solicited the aid of Mr. V. FitzSimons of the Transvaal Museum who very kindly supplied me with the data of thirty-six specimens in his care.

Of forty-six specimens of *lutrix* in the Museum of Comparative

Zoölogy and Transvaal Museum, forty-three have a loreal on both sides of the head, only two (from Tokai, near Cape Town and St. Lowry's Pass) lack this shield on both sides of the head while T. M. No. 5167 has no loreal on the right side only; thirty-nine snakes have 2 postoculars on both sides of the head, two have 2 on the left but only 1 on the right while five have 1 postocular on both sides of the head (from Port Elizabeth; Natal; and 3 Transvaal localities); of one of these Mr. FitzSimons states that it is accompanied by eight young all of which are typical *lutrix*.

Of the forty-two specimens listed above and one from Arusha, also in Tanganyika Territory, forty-one have no loreal, the Arusha and one Ilolo snake possess a loreal; thirty-three snakes have 1 postocular, five have 2 on one side of the head only (from Ihanganya; Kigogo and Ilolo) and five have 2 postoculars on both sides of the head (Kigogo). That is to say the great majority of snakes from north of the Zambesi may be differentiated from their southern relatives by the absence of a loreal and presence of a single subocular. Under these circumstances I feel justified in reviving the name *shiranum* in a subspecific sense, thus:—

A loreal (absent in 7%) and two postoculars (or 1 only in 16%); a dark vertebral band usually present; range south of the Zambesi . . . . *lutrix lutrix*

No loreal (present in 4%) and only one postocular (or 2 present in 18%); no definite vertebral band; range north of the Zambesi . . . . *lutrix shiranum*

Sternfeld has listed some intermediates from the Central African lake region and has proposed the name of *atriventris* for one with a black undersurface, a loreal and a single postocular. The Kigogo series shows that there is no significance in the color of the belly which is very variable. *H. l. atriventris* must be regarded as a synonym of *D. l. shiranum*.

Variation. Midbody scale-rows 15; ventrals 126–151; anal single; subcaudals 24–46; labials 6, the 3rd and 4th entering the eye in 38 snakes, the 2nd, 3rd and 4th in Nos. 30179 and 30191, the 3rd, 4th and 5th in No. 30186, while No. 30188 is normal on the left side but has 7 labials with the 3rd, 4th and 5th entering on the right; thirty-two snakes have a single postocular, five have a single shield on one side and two on the other, five have two on both sides of the head.

Coloration. Great variation was observed in the Kigogo series and this was found to be uncorrelated with sex. The following notes were made in the field. 13. i. 30. Male. Above, olive extending to the

outer edges of the ventrals. Below, uniformly pale yellow. Female. Above, black. Below, white or greyish-white with irregular black blotches. 23. i. 30. Of four females brought in two were black and one a rich red-brown with a vertebral series of minute black stripes. 30. i. 30. Four females brought in present astonishing variation in color.

Measurements. The largest male is from Mangoto and measures 379 (300+79) mm., the largest female is from Kigogo and measures 412 (362+50) mm., the smallest snake, also from Mangoto, is only 118 (93+25) mm. in length and can have been born but recently for Barbour and I have recorded an embryo of 100 (85+15) mm. from Lulonga, Belgian Congo.

Sex. One is at once struck by the greater length of the tails in the males and this is correlated with a higher number of subcaudals; the majority of snakes were sexed in the field and I think that the following key is a fairly accurate means for distinguishing sex in this region. It may be that some few males have fewer than 40 subcaudals (Boulenger has recorded one with 35 from South Africa under *lutrix* and his *abyssinicum* type had 32) but in general they range higher.

Length of tail included in total length 4.2 to 5.1 times, caudals usually over 40 (41–46 in above series) . . . . *males*

Length of tail included in total length 6 to 9 times, caudals always less than 40 (25–38 in above series) . . . . *females*

Breeding. At Kigogo, on 23. i. 30, three females holding eggs, viz. (1) 13 eggs measuring 11 x 6.5 mm., (2) 9 eggs measuring 9 x 6 mm., (3) 4 eggs measuring 10 x 6 mm. At the same locality but on 30. i. 30 four more females were taken holding 12, 11, 9 and 8 eggs respectively, all approximated to 12 x 8 mm. and were larger, therefore, than in the snakes taken a week before. It was observed that a very good ratio was kept between the size of the snake and the number of ova which it held, the smaller snakes having proportionately fewer ova developing.

At Madehani, on 14. ii. 30, five females with 12, 10, 8, 7 and 7 eggs respectively, those of one of the latter measuring 10 x 6 mm.; there was very little sun at Madehani during the whole month.

Diet. These small snakes subsist almost exclusively upon slugs, even a very young Ilolo reptile disgorged a slug when captured and slugs were taken from the stomachs of snakes caught at Kigogo, Mangoto and Madehani. In addition to a slug I removed a 125 mm. *Duberria l. shiranum* from the stomach of a Madehani snake.

Parasites. Nematode worms were recovered from both the stomachs and intestines of snakes taken at Dabaga and Kigogo.

Enemies. Cannibalistic as related above.

Habitat. The first specimens captured at Dabaga were found in rich short grass in marshland in a broad valley. They were presumably basking on the top of the grass tussocks where their olivaceous color rendered them inconspicuous; as one approached they wriggled into the roots of the grass where they were almost impossible to find.

At Kigogo a large series was secured by natives engaged in hoeing over grassland on a hillside in preparation for extensive planting by the forest officer. The Ihanganyi snake was taken by myself as it was about to cross the path in grassland at sunset.

Near Kigogo a settler, whose native employees were clearing land at the edge of forest for planting coffee, informed me that "blind snakes" were very abundant and that in digging a furrow forty feet in length they had destroyed over ninety of them! As I found no *Typhlops* in the Uzungwe Mountains I concluded that he referred to *Duberria.* In view of the great economic value of these snakes in a coffee plantation by reason of their diet of slugs they deserve protection by all intelligent settlers; the same applies to *Typhlops* which subsists almost entirely on termites (white ants) with an occasional caterpillar or slug.

Duberria l. shiranum fills a niche in the East African fauna which is occupied by *Storeria dekayi* in the North American. There is considerable similarity in external appearance and size, in diet, in habitat and hiding places, and in their ovoviviparity.

Prosymna ambigua Bocage

Prosymna ambigua Bocage, 1873, Journ. Sci. Lisboa, **4**, p. 218: Duque de Bragança, Angola; Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl. **50**, pp. 121–122: East Africa.

Prosymna variabilis Werner, 1909, Jahresh. Nat. Ver. Wurttemb., **65**, p. 57: Moshi, Tanganyika Territory.

♂ (M. C. Z. 30203) Bagamoyo, ii. xi. 29.
♂ (M. C. Z. 30204) Mpwapwa, Ugogo. 22. xi. 29.

Distribution. Sternfeld has recorded *ambigua* from Zanzibar and Bukoba.

Affinities. I am still unconvinced that the name *ambigua* is the correct one to apply to East African snakes for all that I have seen have had 15 scale-rows while *ambigua* (Angola) had 17; perhaps the name *bocagii* (Congo) should be revived as a race of *ambigua* and

applied to Congo and East African snakes with 15 scale-rows. I have no western material to enable me to form an opinion of any value. A full discussion of the relationships of East African snakes to *bocagii* will be found in the 1928 citation given above.

Due to the kindness of Dr. Wilhelm Götz, I have been enabled to examine the ♀ cotype of Werner's *P. variabilis* and have no hesitation in referring it to the synonymy of *ambigua* (or rather *bocagii*). The chief claim of *P. variabilis* to specific rank was its rounded snout which is prominent, sharp and slightly upturned in *bocagii*. Hewitt has stated with regard to his series of *P. transvaalensis* that in the young the rostral is not so angular as in the adults. Obviously the rounded snout is ancestral and its shovel-like development is correlated with subsequent adaptation to burrowing habits. The ♀ cotype of variabilis is so young that the ventral scutes in the umbilical region are still unhealed, it measures 95 (86+9) mm. and the male cotype (whose whereabouts I have been unable to trace) was only 122 mm. Both agreed with the type of *bocagii* in all essentials though the antero-lateral angles of the frontal do not reach the eyes in *variabilis,* a character which has been shown to be variable. The ventral counts of the types of *variabilis* are 140–143 and that of the type of *bocagii* 167 but both are within the recognized range of variation.

Variation. Midbody scale-rows 15; ventrals 136–137; subcaudals 31–33; labials 6, the 3rd and 4th entering the eye; postoculars 1 except on the right side of the head of the Mpwapwa snake where there are 2, while 2 is normal for *ambigua,* 1 is by no means uncommon.

Measurements. The larger snake, from Bagamoyo, measures 205 (175+30) mm., the smaller one only 130 (112+18) mm.

Habitat. The Mpwapwa snake was taken in sandy debris among the rotten roots of a fallen tree lying fifty feet from a stream; owing to prolonged drought the ground was dry and dusty at the time.

DASYPELTINAE

Dasypeltis scaber (Linnaeus)

Coluber scaber Linnaeus, 1766, Syst. Nat., **1**, p. 384: Indiis.

1 (M. C. Z. 30205) Maji Malulu, Usandawi. 10. xii. 29.
1 (M. C. Z. 30206) Mwaya, Lake Nyasa. 1–8. iii. 30.
2 (M. C. Z. 30207–8) Ukerewe Id., Lake Victoria. 10. vi. 30.

Distribution. Recorded by Sternfeld from Dar es Salaam, Mpwapwa, etc., by Roux from Bukoba.

Variation. Midbody scale-rows 25–27; ventrals 211–230; subcaudals 47–63; labials 7, the 3rd and 4th entering the orbit.

Coloration. All four are of the rhombic type but the alleged model, *Causus rhombeatus* has not been recorded from any of these localities. It is interesting to note, however, that the young Egg-eater from Mwaya was thought to be the young of *Vipera superciliaris* by the Banyakusa.

Measurements. The largest, a female from Ukerewe Island, measures 804 (720+84) mm., the smallest from Maji Malulu, only 224 (190+34) mm.

Diet. The first snake brought to me after our arrival on Ukerewe Island was an Egg-eater. I placed it in a vivarium and gave it a bronze Mannikin's (*Spermestes. e. scutatus*) egg which it took; later two more eggs of the same species were removed from the stomach of a Boomslang (*Dispholidus typus*) and though they were slightly cracked they were promptly taken.

Enemies. A hedgehog (*Atelerix a. hindei*) was placed in the same cage for a couple of days and never molested the snake, on the third day, however, a larger and well-conditioned Egg-eater was temporarily placed in the same cage at noon but when I went to remove both snakes at sunset I found that the hedgehog had already nibbled a small hole in the belly of the still living snake and started to disembowel it.

Habitat. The young Maji Malulu snake was found coiled beneath the skirting of the tent; when found it struck out open-jawed and kept its mouth wide-open all the time until picked up. I have never known an adult Egg-eater menace its would-be captor for they are among the most docile of snakes.

BOIGINAE

Tarbophis semiannulatus (Smith)

Telescopus semiannulatus A. Smith, 1849, Illus. Zoöl. S. Africa, **3**, pl. 72: No locality given. (South Africa.)

♂ (M. C. Z. 30209) Bagamoyo. 14. xi. 29.

Distribution. Recorded by Sternfeld from Dar es Salaam, Ugogo, Lake Nyasa, Tukuyu and Lake Tanganyika.

Variation. Midbody scale-rows 19; ventrals 212; anal divided; subcaudals 74; labials 8, the 3rd, 4th and 5th entering the orbit.

Measurements. Total length of this ♂ 555 (450+105) mm.

Diet. A Palm Gecko (*Phelsuma dubium*) was recovered from its stomach.

Parasites. Larval acanthocephalans were encysted on the intestinal wall.

Habitat. Taken at a height of eight feet from the ground in a young coconut palm.

CROTAPHOPELTIS HOTAMBOEIA HOTAMBOEIA (Laurenti)

Coronella hotamboeia Laurenti, 1768, Syn. Rept., p. 85: India orientali, i.e. Africa.

1 (M. C. Z. 30210) Unyanganyi, Turu. 4. xi. 29.
22 (M. C. Z. 30211–32) Mwaya, Lake Nyasa. 1–8. iii. 30.
4 (M. C. Z. 30233–6) Kitungulu, Urungu. 15. v. 30.
5 (M. C. Z. 30237–41) Ujiji, Lake Tanganyika. 28. v. 30.
1 (M. C. Z. 30242) Ukerewe Id., Lake Victoria. 12. vi. 30.
1 (M. C. Z. 30243) Entebbe, Uganda. 28. vi. 30.

Distribution. Recorded from Bukoba by Roux.

Native names. *Kiko* (Kinyakusa); *tukompe* (Kirungu); ? *swela* (Kijiji, but probably error as this is the Kinyamwezi name for *Naja nigricollis* which is also black).

Corrigenda. Under the heading "Variation" in Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl. **50**, p. 125, the word "not" was dropped out in the typing of the paper where it should read "preocular *not* in contact with the frontal."

Variation. Midbody scale-rows 19; ventrals 156–172; anal single; subcaudals 29–46; labials 8, the 3rd, 4th and 5th entering the orbit except in No. 30229 where there are 9 with 4th, 5th and 6th entering, and No. 30220 where this condition, due to a division of the 2nd labial, occurs on one side of the head only; 1 preocular not in contact with the frontal except in No. 30233 and on right side of No. 30222; postoculars 2, except No. 30214 which has 3; temporals 1+2 except in Nos. 30224 and 30233 where 1+1, due to the division of the anterior temporal, occurs on the left side of the head only; twelve snakes have 3 pairs of chin-shields, three have a 3–4 arrangement, eighteen have 4 pairs, and one (No. 30238) has 5.

Coloration. In the Ukerewe Island snake the throat is deep black while in No. 30219 from Mwaya the underside of the tail is black.

Measurements. The largest male measures 573 (500+73) mm. and is from Ujiji, the biggest female is from Mwaya and measures 570 (500+70) mm.

Breeding. Eight of the Mwaya snakes are under 210 mm., the smallest measuring 150 (130+20) mm., the whole Kitungulu series are also young being under 242 mm. in total length.

Diet. Stomach contents consisted of.—(1) A mouse (? *Leggada bella*) at Mwaya, (2) a toad (*Bufo r. regularis*) at Ujiji, (3) Small frogs (*Arthroleptis xenodactylus*) in each of the four snakes from Kitungulu.

Habitat. I took all the Kitungulu snakes in the course of a morning. They were beneath the bark, or in cavities, of fallen logs on the edge of dry forest.

Crotaphopeltis hotamboeia tornieri (Werner)

Leptodira tornieri Werner, 1876, Sitzber. Akad. Wien, **116**, p. 1875: Amani, Usambara Mtns., Tanganyika Territory.

Crotaphopeltis hotamboeia tornieri Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, pp. 126–128: Usambara and Uluguru Mtns.—many localities.

2 (M. C. Z. 30244–5) Dabaga, Uzungwe Mtns. 1. i. 30.
1 (M. C. Z. 30246) Kigogo, Uzungwe Mtns. 13. i. 30.
7 (M. C. Z. 30247–53) Madehani, Ukinga Mtns. 14–28. ii. 30.
21 (M. C. Z. 30254–74) Nkuka Forest, Rungwe Mtn. iii. 30.

Distribution. Hitherto only known from the Usambara and Uluguru Mountains.

Native names. Nyamweru (Kihehe); *nyoka naliombo* (Kikinga).

Corrigenda. On line 1 and line 15 of the 1928 citation given above for "3 preoculars" read 2 preoculars; it is correct but blurred in the typescript but was altered in its passage through the press.

Variation. Midbody scale-rows 17; ventrals 162–175; anal single; subcaudals 35–48; labials usually 8, the 3rd, 4th and 5th entering the orbit, but No. 30257 has 7 with 3rd and 4th entering, three snakes have 8 with 4th and 5th, two snakes have 9 with 4th, 5th and 6th while three others have this arrangement on one side of the head only, the other side being normal; 2 preoculars in twenty-seven snakes, 1 preocular in No. 30257 while three display an azygous arrangement with 2 on one side and 1 on the other, the preocular is *not* in contact with the frontal in eighteen snakes and *is* in contact in thirteen; postoculars 2 in twenty-one snakes, 3 in five and an azygous combination in five; temporals 1+2 in all but two snakes where they are 1+1 and No. 30264 which has an azygous combination.

It will be seen that the differences between *C. h. hotamboeia* and *C. h. tornieri* are more sharply emphasized in this fresh material than

they were in those from the Uluguru and Usambara Mountains and adjacent regions. Combining the information now available the two races may be distinguished as follows:—

Scales in 19–21 rows (17 in one from the Cape fide Boulenger); ventrals 144–180; subcaudals 29–54; preocular 1 (rarely 2); postoculars 2 (rarely 1). Habitat outside rain forest, chiefly at low altitudes. . . . . *C. h. hotamboeia*

Scales in 17 rows (rarely 19, i.e. 10% of 76 snakes); ventrals 145–175; subcaudals 35–56; preoculars 2 (rarely 1, i.e. in 21% of 76 snakes); postoculars 2 (rarely 3). Habitat always in rain forest at high altitudes. . . . . *C. h. tornieri*

In life the forms are more readily separable than in the laboratory.

Coloration. Young snakes are white beneath, while the adults are usually dusky, occasional specimens are as deep plumbeous below as above. The following notes were made in the field: Kigogo. Above, iridescent blue-black; a portion of the upper labials cream-colored. Below, throat white; ventrals cream, edged laterally with smoky-grey; subcaudals very pale smoky-grey. Eye red with blue-black vertical pupil. Madehani. Above, iridescent olive on head, plumbeus or blue-grey on body; upper labials, mental and four anterior lower labials, light yellow. Below, throat white; ventrals greenish-white. Eye orange-red with vertical black pupil.

Measurements. The largest male (Rungwe) measures 581 (505+76+tip) mm., and the biggest female (Dabaga) measures 545 (500+45+tip) mm. It is unfortunate that both the largest snakes have lost the ends of their tails but no others are over 500 mm. in length from snout to anus.

Breeding. The smallest snake measures 145 (125+20) mm. and was taken on March 31, 1930 at Rungwe.

Diet. At Madehani each of three snakes had swallowed a frog (*Arthroleptis reichei*), the feet of a frog (*Probreviceps m. rungwensis*) were recovered from a snake taken in the Nkuka Forest.

Enemies. Six snakes or nineteen per cent of the series have lost the end of their tails.

Habitat. All of these snakes were taken in, or on the edge of, the rain forest, generally coiled beneath the bark of logs or beneath the trunks of fallen trees. None attempted to bite when caught.

AMPLORHINUS NOTOTAENIA (Günther)

Coronella nototaenia Günther, 1864, Proc. Zoöl. Soc. London, p. 309, pl. 26; fig. 1: Rios de Sena, Zambesi.

♀ (M. C. Z. 30276) Nyamkolo, Lake Tanganyika. 9. v. 30.
♀ (M. C. Z. 30277) Kitungulu, Urungu. 14. v. 30.

Variation. Midbody scale-rows 17; ventrals 167–161; anal divided; subcaudals 79–73; labials 8, the 4th and 5th entering the orbit though on the left side of the head of the Nyamkolo snake; a wedge-shaped scale is interposed between the 2nd and 3rd labials and narrowly borders the lip but has been omitted from the count which is otherwise normal.

It might be remarked here that *Amplorhinus taeniatus* Sternfeld from Lamu Island is a synonym of *Hemirhagerrhis kelleri* Boettger; it is surprising that Boulenger did not detect this.

Diet. The tail of a gecko (*Lygodactylus ? stevensoni*) was found in the stomach of the Kitungulu snake.

Habitat. The Kitungulu snake was found resting on the horizontal branch of a fallen tree in dry miombo forest.

TRIMERORHINUS TRITAENIATUS TRITAENIATUS (Günther)

Rhagerrhis tritaeniatus Günther, 1863, Ann. Mag. Nat. Hist. (4), **1**, p. 423, pl. xix, fig. 8: South East Africa.

10 (M. C. Z. 30278–87) Dabaga, Uzungwe Mtns. 1–3. i. 30.
1 (M. C. Z. 30288) Ihanganya, Uzungwe Mtns. 6. i. 30.
1 (M. C. Z. 30289) Ipemi, Uzungwe Mtns. 7. i. 30.
7 (M. C. Z. 30290–6) Kigogo, Uzungwe Mtns. 13–30 i. 30.
1 (M. C. Z. 30297) Lukungu, Ubena Mtns. 8. ii. 30.
1 (M. C. Z. 30298) Ihenye, Ukinga Mtns. 8. ii. 30.
3 (M. C. Z. 30299–301) Mangoto, Ukinga Mtns. 10. ii. 30.
1 (M. C. Z. 30302) Ilolo, Rungwe district. 22. iii. 30.
10 (M. C. Z. 30303–12) Igale, Poroto Mtns. 24–30. iv. 30.

Distribution. Also, according to the Wakinga, abundant in the grasslands at Madehani during the heaviest rains. Sternfeld has recorded *T. rhombeatus* as occurring in these Ukinga Mountains but it probably came from the southern end of the range while Madehani is in the extreme north.

Native names. Nyaluhereka (Kikinga); *isakani* (Kinyakusa, but not even generic as applied to two other striped snakes).

Variation. Midbody scale-rows 17; ventrals 145-162; subcaudals 51-60; labials 8, the 4th and 5th entering the eye; rostral broader than deep as in the synonym *variabilis* from the Shiré highlands. In four snakes only is it as broad as deep.

Coloration. Very young snakes differ from the adults in appearance as the upper labials are white and though their longitudinal stripes are not more numerous they appear to be so as a result of their being in closer juxtaposition in the small reptiles.

Measurements. The largest snake, a female from Igale, measures 993 (827+146) mm. but has the tip of the tail missing; the smallest snake is from Dabaga and measures 186 (148+38) mm.

Sex. Females appear to predominate; in the Igale series for example only two of the ten snakes are males.

Diet. Stomach contents consisted of:—(1) Large shrew (*Crocidura nyanzae kivu*) at Kigogo, (2) rat remains at Igale, (3) skinks (*Mabuya v. varia*) in each of five snakes at Dabaga, Kigogo and Igale, (4) hind limbs of frog (*Rana sp.*) at Dabaga, (5) frog (*Rana f. angolensis*) at Kigogo.

Parasites. Nematodes (*Kalicephalus sp.*) were recovered from the stomach of Dabaga and Ihenye snakes.

Defence. These snakes emit a cloacal discharge similar to that of the European Grass-Snake (*Natrix n. natrix*), the smell being indistinguishable to me, though the quantity of the offensively odoriferous fluid was less.

Temperament. Instead of seeking safety in swift flight like its relatives of the genus *Psammophis*, the Striped Schaapsteker makes for the nearest grass-enveloped shrub and conceals itself at the base, defying all efforts to drive it out; often relying so much on remaining quiet that it may be picked up with ease. Once seized, however, it will thrash about, flatten its body to a surprising extent and sometimes even bite, though this is unusual. The bite, while drawing blood, is not followed by symptoms of poisoning.

Enemies. Fifty per cent of the Igale series have lost the extreme end of their tails while those of the Uzungwe Mountains series are intact.

Habitat. Young snakes were seen in fresh green grass bordering a marsh in a valley at Dabaga. Both the Ihanganya and Ipemi snakes shot across the path between porters who were on the march, the porters killed one and I caught the other. When clearing the site for my tent at Igale one of these snakes was disturbed from the base of a grass-smothered shrub; I caught a second a few minutes later within ten feet of the tent; I captured two more within a couple of hundred

yards and all were taken in less than an hour. Five more were brought in by the natives engaged in building a grass hut for the skinners.

Rhamphiophis acutus (Günther)

Psammophis acutus Günther, 1888, Ann. Mag. Nat. Hist. (6), **1**, p. 327, pl. xix, fig. D: Pungo Andongo, Angola.

♀ (M. C. Z. 30313) Mwaya, Lake Nyasa. 1–8. iii. 30.

Distribution. This record adds a species to the snake fauna of Tanganyika Territory, for hitherto *R. acutus* has been known only from Angola.

Affinities. Perhaps the most important generic character separating *Trimerorhinus* from *Rhamphiophis* has been the possession of 10 to 12 maxillary teeth plus two fangs by the former and 6 to 9 plus 2 fangs by the latter; the specimen before me, however, has 10 plus 2 fangs and on each side anteriorly are two azygous gaps which seem to indicate that the full complement of teeth is 12 plus 2 fangs. The peculiar rostral, hollowed out beneath, remains to separate the genera.

I might add that the coloring of *acutus* is line for line and in every detail identical with that of typical *T. tritaeniatus* except that the lower surface of *acutus* is white and that of *tritaeniatus* is dark except for occasional pale specimens. This is a further indication of the very close relationship between the two reptiles, *acutus* appearing to form a connecting link between the genera.

Variation. It differs from the type in that each loreal has a portion split off the lower part and the preocular is narrowly *separated* from the frontal; in number of ventrals and subcaudals and other scale formulae it is identical with the type though the former was a male.

Measurements. Total length 825 (670+155) mm.

Habitat. Taken in hot low-lying country at an altitude of 1,700 feet above sea level; this is in sharp contrast to the habitat of *T. tritaeniatus* which favours the grasslands of the high plateaux at 5,000 feet and over.

Rhamphiophis oxyrhynchus (Reinhardt)

Psammophis oxyrhynchus Reinhardt, 1843, Dansk. Vidensk. Selsk. Skrift., **10**, p. 244, pl. i, figs. 10 and 12: Guinea, West Africa.

Rhamphiophis connali Parker, 1929, Ann. Mag. Nat. Hist, (10), **4**, p. 449: Accra, Gold Coast.

Parker has recently proved conclusively that Boulenger was in error in considering that West and East African snakes were referable

to a single species for which Boulenger employed the name *Rhamphiophis oxyrhynchus* in the Catalogue of Snakes, **3**, p. 146. Having done this Parker proposed the name *R. connali* for West African snakes from the Gold Coast, Dahomey and Nigeria. Unfortunately Reinhardt's type came from Guinea, West Africa and whether we regard that locality in its present restricted sense or in the vague Gambia to Gaboon fashion prevalent a century ago, makes little difference, for the fact that Reinhardt's snake was of West African origin is proved by his statement that it had a single preocular.

Another name must be sought for East African snakes and the earliest available appears to be *Rhamphiophis rostratus* described by Peters in 1854 and of whose identity there can be no doubt, for a fine colored plate was published shortly after the original description.

Rhamphiophis rostratus Peters

Rhamphiophis rostratus Peters, 1854, Monatsb. Akad. Wiss. Berlin, p. 624; 1882, Reise nach Mossamb., **3**, p. 124, pl. xix, fig. 1: Tete; Mesuril; Quitangonha, Mozambique.

1 (M. C. Z. 30314) Dar es Salaam. 8. xi. 29.
2 (M. C. Z. 30315–6) Bagamoyo. 16. xi. 29.
6 (M. C. Z. 30317–22) Mangasini, Usandawi. 16. xii. 29.

Distribution. Recorded by Sternfeld from Dar es Salaam, Mpwapwa, Bukoba etc.

Affinities. The name *rostratus* has had to be revived for all East African snakes hitherto known as *oxyrhynchus* since Parker has shown that West Coast snakes differ in possessing a single preocular and a preanal scale count that never falls below 15 rows.

Variation. Midbody scale-rows 17; preanal scale-rows 13; ventrals 165–192; anal divided; subcaudals 104–113; labials 8, the 4th and 5th entering the eye except in three snakes where only the 5th enters; in these snakes, and one other, there are 3 preoculars, the remaining five have 2 preoculars, in no specimen are these in contact with the frontal; anterior chin-shields are as long as the posterior except in Nos. 30314–5 where they are shorter.

Measurements. None is of exceptionally large size, the biggest (No. 30317) being only 1,335 (930+405) mm.

Diet. Stomach contents consisted of:—(1) Lizard (*Eremias s. spekii*) at Mangasini, (2) skink (*Riopa s. sundevallii*) and three frogs (*Arthroleptis s. stenodactylus*) in the Dar es Salaam snake, (3) an elater beetle in the fully adult Bagamoyo reptile.

Dromophis lineatus (Duméril & Bibron)

Dryophylax lineatus Duméril & Bibron, 1854, Erpét. Gén., **7**, p. 1124: White Nile, Africa.

3 (M. C. Z. 30323–5) Mwaya, Lake Nyasa. 1–8. iii. 30.
1 (M. C. Z. 30326) Nyamkolo, Lake Tanganyika. 9. v. 30.
1 (M. C. Z. 30327) Ujiji, Lake Tanganyika. 29. v. 30.

Distribution. Previously recorded from Tukuyu and Ipiani, near Mwaya, by Sternfeld.

Native name. Isakani (Kinyakusa, but not even generic).

Variation. Midbody scale-rows 17; ventrals 146–154; anal divided; subcaudals 83–85; labials 8, the 4th and 5th entering the eye; preocular 1, not in contact with the frontal; postoculars 2 except in the Ujiji snake which has a single postocular on the right side; temporals normal in two snakes only, i.e. 1+2, azygous in the other three as 1+2, 1+3, 2+2 and 2+3. Boulenger in his 1915 key differentiates the genus *Dromophis* from *Psammophis* on the grounds that the former has only a single temporal and the latter two but the Nyamkolo snake has 2 on both sides of its head and a Mwaya snake on one side only.

Coloration. Though easy to recognise in life, when preserved this species is strikingly like *Psammophis subtaeniatus,* all five specimens, however, have the *transverse* lateral streaks on the ventrals while *P. subtaeniatus* usually has longitudinal lines but never transverse.

Measurements. All are females, the largest being 861 (600+261) mm., and is from Mwaya.

Breeding. The Ujiji snake held six eggs each measuring 15 x 6 mm.

Diet. A frog (*Rana m. mascareniensis*) was found in the Ujiji snake.

Psammophis subtaeniatus Peters

Psammophis sibilans var. *subtaeniata* Peters, 1882, Reise nach Mossamb., **3**, p. 121: Boror and inland from Tete, Mozambique.

5 (M. C. Z. 30328–31, 30339) Unyanganyi, Turu. 4. xii. 29.
2 (M. C. Z. 30337–8) Saranda, Ugogo. 29. xi. & 18. xii. 29.
21 (M. C. Z. 30340–60) Mangasini, Usandawi. 12–16. xii. 29.
2 (M. C. Z. 30332–3) Mwanza, Lake Victoria. 6. vi. 30.
1 (M. C. Z. 30370) Ukerewe Island, Lake Victoria. 12. vi. 30.

Distribution. Another was seen crossing the road ten miles south of Bagamoyo. The species has been recorded by Sternfeld for Kitopeni; Lake Nyasa; Tukuyu and Ukerewe Island.

Native name. *Nne*, followed by a click (Kisandawi).

Variation. Midbody scale-rows 17; ventrals 153–176; anal divided; subcaudals 86–115; preocular 1, rarely 2; temporals very variable 1 over 2+2 or 3, 2+2, 2+3; rostral broader than deep in twenty-five snakes, as broad as deep in six demonstrating that this character, utilized by Boulenger in his 1915 key to distinguish *subtaeniatus* from *sibilans* is useless. Though they are good and full species, I am at a loss to differentiate these two snakes by anything but color. Sternfeld reached the same conclusion in 1908.

Coloration. The pair of longitudinal lines along the whole undersurface serve to distinguish this species from *sibilans*, the Saranda, Mangasini and Ukerewe Island snakes are by no means typical for the lines, instead of being sharply defined are dusky, sometimes very faint and in others broken up into a series of dashes, the line usually separates the cream-colored belly from the ventro-lateral band of white. The bigger snakes from these localities were so similar to *sibilans* in their dorsal coloration that I considered them to be referable to that species in the field.

Measurements. In size also these large Mangasini snakes surpassed the largest *subtaeniatus* with which I was acquainted and forty-six were secured on a former tour. The biggest snake (No. 30340) in the present series measured 1,370 (1,030+340) mm., the smallest (No. 30338) was 332 (225+107) mm.

Diet. One Mangasini snake held a rat (*Rattus r. kijabius*), another a lizard (*Eremias s. spekii*) while each of two Unyanganyi reptiles had swallowed a lizard (*Nucras b. boulengeri*).

Parasites. Nematodes (♀, and immature *Spiuroidea*) were recovered from the Mangasini and Ukerewe Island snakes.

Psammophis sibilans (Linnaeus)

Coluber sibilans Linnaeus (part), 1766, Syst. Nat., 12th ed., **1**, p. 383: "Asia.'

1 (M. C. Z. 30334) Dar es Salaam. 8. xi. 29.
2 (M. C. Z. 30335–6) Bagamoyo. 14. xi. 29.
4 (M. C. Z. 30361–4) Mwaya, Lake Nyasa. 1–8. iii. 30.
1 (M. C. Z. 30365) Igale, Poroto Mtns. 30. iv. 30.
2 (M. C. Z. 30366–7) Near Ikombo, N. Rhodesia. 6. v. 30.
1 (M. C. Z. 30368) Nyamkolo, Lake Tanganyika. 9. v. 30.
1 (M. C. Z. 30369) Kalambo River, Lake Tanganyika. 12. v. 30.

Distribution. Also recorded by Sternfeld from Bagamoyo and Ukerewe Island, and by Roux from Bukoba.

Native names. *Ngaruka* (Kinyakusa); *mlalu* (Kirungu).

Variation. Midbody scale-rows 17; ventrals 159–179; anal divided; subcaudals 86–100; rostral broader than deep in nine snakes, as broad as deep in three; see remarks regarding the specific value of this character under *P. subtaeniatus*.

Coloration. Both Bagamoyo snakes are very young, one has fine speckling on the ventral scutes while the other has these scales unspotted.

Measurements. The largest snake (No. 30362) is 1,245 (1,000+245) mm. in length but lacks the end of its tail; the smallest snake (No. 30336) is 310 (220+90) mm.

Diet. Stomach contents consisted of:—(1) Skink (*Mabuya maculilabris*) at Mwaya, (2) frog (*Arthroleptis minutus*) at Mwaya, (3) frog (*Rana m. mascareniensis*) at Nyamkolo.

Parasites. Nematode worms (*Physaloptera paradoxa* and *Kalicephalus sp.*) were found in the stomach of a Mwaya snake; indeterminate nematodes in a Nyamkolo specimen.

Habitat. One of the juvenile snakes from Bagamoyo was found in the market. Our lorry ran over the large Hissing Sand Snake which was crossing the road near Ikombo; later the same morning I captured the smaller one which was ensconced on the dashboard, presumably it had been swept on to the car from the dense grass and brush through which we had been driving. The reptile listed from Kalambo River was in a hollow gourd lying on a sandy waste near the mouth of the Kalambo River but on the southern, i.e. North Rhodesian, bank.

Psammophis biseriatus Peters

Psammophis biseriatus Peters, 1881, Sitzb. Ges. Naturf. Freunde Berlin, p. 88: Taita, Kenya Colony.

1 (M. C. Z. 30371) Kilimatinde, Ugogo. 26. xi. 29.
2 (M. C. Z. 30372–3) Unyanganyi, Turu. 4. xii. 29.
9 (M. C. Z. 30374–82) Mangasini, Usandawi. 12–16. xii. 29.
4 (M. C. Z. 30383–6) Kikuyu, Ugogo. 21. xii. 29.

Native name. *Kutlaku*, with a click (Kisandawi).

Variation. Midbody scale-rows 15; ventrals 150–155; anal divided; subcaudals 97–114; labials 9, the 4th, 5th and 6th entering the eye; temporals azygous in four snakes so that twenty sides have 2+3, eleven have 2+2 and one is 1+2 in defiance of the key in the Catalogue of Snakes, in two specimens the lower of the anterior pair of temporals has been subdivided vertically.

Measurements. The largest snake, a female from Mangasini, measures 865 (565+300) mm.; the smallest is from Unyanganyi and measures 300 (200+100) mm. but six snakes taken early in December are 325 mm.

Diet. A Two-striped Sand Snake was disturbed on the path near Maji Malulu on 10. xii. 29 as it was about to swallow a lizard (*Nucras b. boulengeri*) whose head was already in its mouth. As I jumped from my cycle and attempted to grab the snake the latter made off at great speed carrying the lizard, I eventually lost trace of it in a tangle of fallen thorn bush.

Skinks (*Riopa sundevallii modestum*) were recovered from the stomachs of two of the Mangasini reptiles.

Parasites. An indeterminate female ascarid was taken from the anus of one Mangasini snake.

Habitat. At Dodoma a young one was seen near a manyara hedge at sunset. At Kilimatinde a young one was taken at 4 p.m. among rubble in the old fort; just after sunset the same evening an adult darted into a pile of river debris in the river bed. At Mangasini I was returning to camp in a rainstorm when one of these snakes crossed the path and ascended a thorn tree in which I caught it; this occurred at 6 p.m. or about half-an-hour before dark. Driving from Dodoma to Iringa I saw two on the road but both within ten miles of Dodoma.

Psammophis angolensis (Bocage)

Amphiophis angolensis Bocage, 1872, Jorn. Sci. Lisboa, **4**, p. 82: Donda, interior of Angola.

1 (M. C. Z. 30387) Unyanganyi, Turu. 3. xii. 29.

Distribution. Recorded by Boulenger from Lakes Nyasa, Tanganyika and Victoria.

Variation. The example of this rare little snake is wholly normal with midbody scale-rows 11; ventrals 149; subcaudals 64 and answering in all respects to the revised description in the Catalogue of Snakes, **3**, p. 170.

Measurements. Total length 328 (245+83) mm.

Habitat. Taken in an *mbugwe* or dried-up flat.

Thelotornis kirtlandii (Hallowell)

Leptophis kirtlandii Hallowell, 1844, Proc. Acad. Nat. Sci. Phila., p. 62: Liberia.

♂ (M. C. Z. 30388) Kitungulu, Urungu. 15. v. 30.

Distribution. Sternfeld lists the Bird Snake from Mpwapwa, Lake Nyasa and Lake Victoria. I was shown a large example at Ilolo.

Native names. *Lukukuru* (Kikami); *lukungu* (Kinyika); *nondo* (Kirungu); *nalakutu* (Kiyao).

Variation. Midbody scale-rows 19; ventrals 159; subcaudals 145.

Measurements. Total length 1,140 (690+450) mm.

Habitat. This snake was obtained under rather unusual circumstances. There was a huge heap of dry grass and rubbish surrounding the base of two great trees in a native clearing. I had the heap ignited as it seemed probable that there would be cobras in such an ideal spot. The heat from the blaze rose into the trees though the flames fell far short; towards the end of the conflagration this Bird Snake dropped from a height of at least twenty feet. Though I saw it fall I mistook it for a branch till a shout from one of the "boys" drew my attention to the departing snake which I pursued and captured among the standing maize.

Dispholidus typus (Smith)

Bucephalus typus A. Smith, 1829, Zoöl. Journ., **4**, p. 441: Old Latakoo, South Africa.

1 (M. C. Z. 30389) Mpwapwa, Ugogo. 22. xi. 29.
2 (M. C. Z. 30390–1) Unyanganyi, Turu. 6. xii. 29.
1 (M. C. Z. 30392) Masiliwa, Turu. 10. xii. 29.
3 (M. C. Z. 30393–5) Mangasini, Usandawi. 14. xii. 29.
1 (M. C. Z. 30396) Mwaya, Lake Nyasa. 1–8. iii. 30.
1 (M. C. Z. 30397) Ukerewe Id., Lake Victoria. 12. vi. 30.
1 (M. C. Z. 30398) Kampala, Uganda. vi. 30.

Distribution. Sternfeld has already recorded the Boomslang as occurring at Mpwapwa and Ukerewe Island, also at Dar es Salaam and Bukoba.

Native name. *Imbindipindi* (Kinyakusa, but applied to all green tree snakes).

Variation. Midbody scale-rows 19; ventrals 171–188; anal divided; subcaudals 95–111; labials 7, the 3rd and 4th entering the orbit except on the left side of No. 30390 where there are 8 labials with 4th and 5th entering the orbit; preocular 1; postoculars 3; temporals 1+2 except in No. 30396 where they are 2+2 and No. 30390 where they are 2+3 on the right side and 1+3 on the left side of the head.

Coloration. The Mpwapwa and Ukerewe Island snakes are altogether green; the Mwaya, Kampala and one Mangasini snakes are

green with black markings; the largest of the three Mangasini snakes was olive-color and extraordinarily like a Mamba (*Dendraspis angusticeps*); the medium-sized one was vinous with white labials and sufficiently like a Bird Snake (*Thelotornis kirtlandii*) for me to mistake it for that species in the field; the two young Unyanganyi snakes were noted in life as "Above, dark brown with pale blue speckling particularly conspicuous on the neck which is otherwise black, the skin in this region which is shown when the neck is inflated, is of the same shade of pale blue; upper labials and throat white with a patch of pale yellow at the base of the jaws; the rest of the lower surface brownish grey with dark brown mottlings."

Measurements. The largest specimen, though at least a hundred millimetres of its tail are lacking, is a male from Mangasini which measures 1,495 (1,210+285+tip) mm.

Diet. Mr. Evans of the Veterinary Station, Mpwapwa described a large green snake to me which was almost certainly a Boomslang. It lived in the roof of his house and from time to time raided the swallows' nests from which he had seen it carry off the young.

I was cycling along a path near Masiliwa when I observed an olive-green Boomslang on the ground swallowing a frog (*Leptopelis bocagii*). As I was about to seize the snake it disgorged its prey; later I found a second specimen and a partly-digested *Breviceps mossambicus* in its stomach.

A Mangasini snake had eaten a chameleon (*Chamaeleon d. dilepis*).

While I was sitting writing in my tent I heard a slight commotion among the dry leaves beneath a mango tree a hundred feet away and near the mission station on Ukerewe Island. A native was jumping about very actively and slashing the ground with his stick, now here, now there. Running to the spot I was in time to capture a vivid green Boomslang before he annihilated it. The native said that he was walking beneath the tree when the snake fell down close behind him. In its stomach were a clutch of eggs of the Ethiopean Bronze Mannakin (*Spermestes c. scutatus*) a species which had several nests in the foliage of the mango where I had observed the birds, some of the eggs were unbroken, the others may have been broken by blows from the native's stick.

Parasites. A nematode, which was not preserved, was found in the stomach of the last-mentioned snake.

Defence. The Mpwapwa snake, quite a large one, was disturbed by Salimu and came straight down the ravine towards me. I pinned it as it would have passed, but only by the tail, whereupon it raised itself

high in the air and menaced me with open jaws and inflated throat, its head was level with my face for it was higher up the bank than I was. Having nowhere else to keep it I put it in an empty kerosene tin for twenty-four hours, on removing it I found the creature was quite stupified, presumably by the smell for the tin had been placed in a cool stone room.

Calamelaps unicolor (Reinhardt)

Calamaria unicolor Reinhardt, 1843, Dansk Vidensk. Selsk. Skrift., **10**, p. 236, pl. i, figs. 1–3: Guinea, West Africa.

Calamelaps polylepis Bocage, 1873, Jorn. Sci. Lisboa, **4**, p. 216: Dondo, interior of Angola.

Calamelaps miolepis Günther, 1888, Ann. Mag. Nat. Hist, (6), **1**, p. 323: Cape McClear, Lake Nyasa.

Calamelaps unicolor Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 130: Uluguru and Usambara Mtns., Tanganyika Territory.

1 (M. C. Z. 30399) Mwaya, Lake Nyasa. 1–8. iii. 30.

Distribution. Recorded by Sternfeld from Bagamoyo but he has overlooked Tornier's 1901 paper on specimens from the Tanga-Usambara region.

Native name. Nyeresi (Kinyakusa).

Affinities. The Mwaya snake is almost a topotype of *miolepis* which Boulenger relegated to the synonymy of *polylepis* in 1896. The reasons for considering *polylepis* itself a synonym of *unicolor* will be found in the 1928 citation given above. It has since occurred to me that *polylepis* may stand in the same relation to *unicolor* as does *Crotaphopeltis h. hotamboeia* to *C. h. tornieri*, i.e. that snakes with 17 midbody scale-rows may be restricted to the tropical or mountain rain-forest areas while those with 19 or 21 scale-rows occur only in hot country at lower altitudes. In the main this is supported by the records but is negatived by Sternfeld's Bagamoyo specimen and some others. More material of this rare species is required before a mature decision can be reached.

Calamelaps mellandi, described by Boulenger in 1915 from a male from Chirini Island, Lake Bangweulu, was differentiated from *polylepis* by the absence of a postocular; 2nd upper labial in contact with the prefrontal; 4th upper labial forming a suture with the parietal; and 181 ventrals. In passing I might say that of four Amani snakes one (No. 23359) has the 2nd upper labial in contact with the prefrontal and two have the 4th upper labial forming a suture with the parietal

as is the case with the Mwaya snake and on one side of the head only in a Lumbo snake. *C. mellandi* remains distinguished by the absence of a postocular, a character of doubtful specific value in a species where the postocular is already reduced to a mere vestige.

Variation. Midbody scale-rows 19; ventrals 177; anal divided; subcaudals 28; labials 6, the 3rd and 4th entering the orbit, postocular 1; temporal 1.

Measurements. Total length 475 (430+45) mm.

RHINOCALAMUS DIMIDIATUS Günther

Rhinocalamus dimidiatus Günther, 1888, Ann. Mag. Nat. Hist. (6), **1**, p. 322, pl. xix, fig. C: Mpwapwa, Ugogo, Tanganyika Territory.

1 (M. C. Z. 30400) Mpwapwa, Ugogo. 23. xi. 29.

Distribution. Only known from the type locality.

Variation. The scalation is normal. Midbody scale-rows 17; ventrals 199; anal divided; subcaudals 26.

Coloration in life. Above, glossy black, except the labials and a lateral band of chrome-yellow; below, white, except for the edges of the ventrals which are, like the tail, chrome-yellow.

Measurements. Total length 400 (365+35) mm.

Habitat. Taken six inches below the surface in a cavity of the rotting roots of a tree-stump which was situated in sand on the banks of the bed of a stream long since dried-up.

MIODON GABONENSIS (Duméril)

Elapomorphus gabonensis A. Duméril, 1856, Rev. Mag. Zoöl. (2), **7**, p. 468: Gaboon, West Africa.

♀ (M. C. Z. 30401) Ilolo, Rungwe. 15. iv. 30.

Distribution. The only record in Africa east of Uganda of which I am cognisant is that of Sternfeld for Dar es Salaam which is also the only record for the occurrence of the genus in this region.

Variation. Midbody scale-rows 15; ventrals 215; anal divided; subcaudals 21; the frontal is once and a half times as broad as the supraocular; the internasals are as long as the prefrontals; the nasal is completely divided though Boulenger states that it is entire or incompletely divided. The genus is badly in need of revision.

Coloration. Uniformly iridescent blue-black above and below.

Measurements. Total length 479 (448+31) mm.

Diet. What is unmistakably the tip of the tail of a blind snake (*Typhlops* or *Leptotyphlops*) was present in the stomach.

Chilorhinophis gerardi (Boulenger)

Apostolepis gerardi Boulenger, 1913, Revue Zoöl. Afr., **3**, p. 103, fig.: Kikondja, Katanga, Belgian Congo.

Parkerophis gerardi Barbour & Amaral, 1927, Bull, Antivenin Inst. Amer., **1**, p. 25; Parker, 1927, Ann. Mag. Nat. Hist. (9), **20**, p. 81: Sinoia, Lomagundi district, S. Rhodesia.

♂ (M. C. Z. 30402) Nyamkolo, Lake Tanganyika. 9. v. 30.

Distribution. This record constitutes the first for Northern Rhodesia and is the third known specimen, since Boulenger's record from Anquabe, Portuguese East Africa has been shown by Parker to represent a distinct species which he called *Parkerophis carpenteri.* I have little doubt that C. *gerardi* will be found near Kasanga in Tanganyika Territory for the natives at Kasanga profess to know it under the first of the two names given below.

Native names. Kasimwanamatengi, kalambanzila (Kirungu).

Affinities. The name Parkerophis proposed by Barbour and Amaral for *gerardi* must be considered a synonym of Chilorinophis, a genus erected by Werner for the reception of *butleri* which he described from the Sudan in 1908 (1907). *Chilorhinophis butleri* has been recorded from Amani, Usambara Mountains, Tanganyika Territory by Sternfeld (1910). Assuming that the identification is correct it forms a link between the Sudan record of *butleri* and the Mozambique one of *carpenteri.* The ventral and subcaudal scale-counts of the two types are widely separated but supposing that they are of different sexes there is a remote possibility of their representing one species.

Variation. Midbody scale-rows 15; ventrals 308; anal divided; subcaudals 26. The type had 276 ventrals and 28 subcaudals, in other respects they agree, I was also afforded the opportunity of direct comparison with the Sinoia snake in the British Museum.

Coloration in life. The original description based on a preserved specimen gives one little idea of the beautiful appearance of the living reptile. Above, crown of head black flecked with yellow on the prefrontals, supraoculars and parietals; it is also black for six scale-rows behind the head except for a pair of yellow flecks just posterior to the parietals; three black bands (a vertebral flanked by dorso-laterals)

proceed from the black patch on the neck and are continued along the body and tail until they merge into the black tip of the tail, this black tip is flecked with yellow like the head; between the bands, and on the flanks, the body color is chrome yellow. Below, the throat is china-white extending upwards to some of the upper labials; the ventrals and a half scale-row on either side are orange as are also the anterior subcaudals followed by two pairs of black subcaudals, then ten pairs of white subcaudals with grey blue centres some of which are flecked with black, the terminal scute of the tail is black.

Measurements. Total length 445 (420+25) mm.

Defence. I saw the reptile wriggling along with its tail held high simulating a head as described and figured by Carpenter for the allied form.

Habitat. This snake was taken on the road leading up to the London Missionary Society's station on the bluff overlooking the bay at Nyamkolo, by men engaged in cleaning weeds off the road. The rains had ceased a month before and the country was already very dry. The villagers stated that the species was not rare at certain seasons but all my efforts to obtain others during the three days we camped at Nyamkolo failed. Curiously enough the veteran missionary Mr. White described this snake to me within an hour or so of my arrival saying that he had seen several twenty-five years ago but none in recent times.

ELAPINAE

Boulengerina annulata stormsi Dollo

Boulengerina stormsi Dollo, 1886, Bull. Mus. Belge, **4**, p. 160, fig: Lake Tanganyika; Boulenger, 1904, Ann. Mag. Nat. Hist. (7), **14**, p. 15; Boulenger, 1919, Revue Zoöl. Afr., **7**, p. 27: Bosabangi, Ituri, Belgian Congo; Boulenger, 1919, Proc. Zoöl. Soc. London, p. 293: Key to species.

♀ (M. C. Z. 30403) Kasanga, Lake Tanganyika. 17. v. 30.
♂ (M. C. Z. 30404) Kipili, Lake Tanganyika. 19. v. 30.

Native names. *Miu* (Kirungu); *Mwiu* (Kifipa); *Mlolo* (Kijiji).

Distribution. Until 1919, when Boulenger referred a specimen from the Ituri to *stormsi*, it was believed that that species was confined to Lake Tanganyika.

Affinities. Schmidt (1923, Bull. Am. Mus. Nat. Hist., **49**, p. 123) has conclusively shown that *B. dybowskyi* Mocquard is synonymous with *B. annulata* (Bucholtz & Peters) and concludes that *stormsi* may be distinguished by its 21 scale-rows (instead of 21–23 found in his

series of *annulata*), a longer tail and different coloration. Boulenger has hinted that the two might not be specifically distinct.

The two specimens listed above effectually dispose of the supposed differences in scale-rows and tail length so that we are left with only a color difference, well-marked in the extreme West and East of the range but intergrading in the Belgian Congo. This difference may be expressed as follows:—

Western form with 20, or more, complete annuli on body *a. annulata*
Eastern form with 2 (rarely 3 or none) annuli on body *a. stormsi*

I am indebted to Mr. H. W. Parker for supplying me with the bulk of the data on which these conclusions are based; it is listed below, together with the other data available to me. Localities are arranged from West to East and North to South.

B. annulata annulata

B. M. #6.	Bitye, S. Cameroon. Adult skin. Black transverse occipital bar; 20 saddle-shaped light centered, black annuli on body; some indistinct annuli on tail.
M. C. Z. 29358.	Lukungg River, Bipindi, S. Cameroon. Adult. Black occipital bar; 5 solid annuli anteriorly on body followed by 15 light centered ones; indistinct annuli on tail.
B. M. #8 & 9.	Benito River, French Congo. Two juveniles. Black occipital bar; 3 solid annuli anteriorly on body followed by 19 light centered ones; indistinct annuli on tail.
B. M. #7.	Ogowé, French Congo. Ad. Black occipital bar; 20 light centered, black annuli on body; indistinct light centered ones on the tail.
B. M. #11.	Gaboon, French Congo. Juv. Black occipital bar; a black bar followed by 3 solid annuli and 18 light centered, black annuli on the body.
B. M. #10.	Ubangi, French Congo. Juv. No occipital bar; a black bar followed by 2 solid annuli and 21 light centered, black annuli on the body.

Intermediate between the two races. (Referred to *annulata* by Schmidt.)

M. C. Z. 13608.	Ngayu, Belgian Congo. Ad. Black occipital bar; 2 solid black annuli followed by about (posteriorly they are very ill-defined) 18 light centered, white spotted, black bars on the body.

B. annulata stormsi

U. S. N. M. 63378.	Ujiji, Lake Tanganyika. Juv. Black occipital bar; 2 solid black annuli followed by ten cross bars some of which show a light line through them, one or two are rather ill-defined.

B. M. #2.	Lake Tanganyika. Juv. Black occipital bar; 2 black annuli followed by 5 cross bars on the body.
B. M. #1.	Lake Tanganyika. Juv. Black occipital bar; 2 black annuli followed by 4 cross bars, becoming shorter posteriorly, on the body.
M. C. Z. 30404.	Kipili, Lake Tanganyika. Ad. Black occipital bar; 2 black annuli followed by 20 cross bars on the body.
M. C. Z. 30403.	Kasanga, Lake Tanganyika. Ad. Black occipital bar; 2 black annuli followed by a single cross bar, posteriorly a very few black blotches represent rudiments of others.
B. M. #3.	Kasawa, Lake Tanganyika. Ad. Narrow, curved, black occipital bar; 2 black cross bars edged with lighter posteriorly on nape.
B. M. #4.	Nyasaland. Juv. Narrow, curved, black occipital bar; 3 black annuli followed by 7 black cross bars which become shorter posteriorly.
B. M. #5.	Nyasaland. Ad. Black occipital bar; 2 black annuli followed by 15 black cross bars on the body, a series of dark, light-centered, blotches on the flanks close to the ventrals, irregularly disposed between the dorsal bars.

With regard to the British Museum specimens Mr. Parker adds, "The two groups appear distinct enough at first sight, particularly if only juveniles are considered. Numbers 5 and 6 are the only ones which might be considered as showing transition from one to the other. Reduction of the saddle-shaped cross-bars of number 6 on the dorsum and venter would leave some light centered blotches on the flanks comparable with those shown by number 5."

Of the specimens in the Congo Museum at Tervueren, Dr. de Witte writes me that he has reëxamined this material and that six snakes are referable to *B. annulata*. These are from Panga; Kobli; Uele; Umangi; Katanga and Poko respectively. To *B. stormsi* he would refer four snakes from Bosabangi; Albertville and Pweto.

Variation. Midbody scale-rows 21–23; ventrals 200–209; anal single; subcaudals 71 in male, tail damaged in female; labials 7, the 3rd and 4th entering the orbit; temporals 1+2; preocular 1; postoculars 2; rostral about 1½ times broader than deep. Schmidt has pointed out the unfortunate nature of the key suggested by Boulenger in 1904 and based on the relative width and depth of the rostral. I might add

that as the species lacks suboculars it is obvious that postocular is intended for subocular in the first part of the key while "two lower labials in contact with the lower subocular" in the second part is obviously a slip; unfortunately some of these errors are repeated in his "List of the Snakes of West Africa." which was published in 1919 (Proc. Zoöl. Soc. London, p. 293).

Measurements. The specimen from Ngayu, Belgian Congo (A.M. N.H. 12329) listed by Schmidt is now in the Museum of Comparative Zoölogy. Curiously enough its total length is exactly that of the male from Kipili, *viz.* 1,385 (1,115+270) mm., though the tail of the Tanganyika snake is 5 mm. shorter than that of the Congo reptile. Obviously there is nothing distinctive in the relative tail length of the two races.

Habitat and Habits. Kasanga is situated on delta flats in the centre of a sandy bay whose arms are formed by rocky promontories projecting into Lake Tanganyika. On one of these the Germans built their important military base of Bismarckburg. Both promontories are protected by natural breakwaters of piled-up masses of rock. It is just off such rocks that the aquatic cobras are to be found.

According to native reports, which my own experience confirmed in some points and contradicted in none, when the sun rises and strikes the rocks the cobras emerge from their retreats beneath them and bask for a short time *on the tops* of the rocks. Shortly afterwards, and I found none on the rocks an hour and a half after sun-up, they take to the water in search of fish. I was told that on a calm day one might see as many as ten in the course of a morning's fishing; we saw four in a little over three hours. The rocks slope precipitously beneath the water so that it is often ten feet deep within ten feet of the shore. I hired a boat and cruised very quietly along shore peering through the clear waters at the jumbled boulders, in and out from among which brilliantly colored small fish in great variety, darted or hovered. At last we saw a great head come out from beneath a rock followed by the handsomely barred neck and body of a large cobra which I estimated as about eight feet in length—native reports allege that they reach a length of ten feet which I do not think improbable.

The natives were greatly excited and urged me to shoot it, so I fired first one and then the second barrel at the snake, which was between three and four feet below the surface; as I should have known, the bullets were deflected and did not penetrate the water; the only effect upon the snake was to cause it to retreat beneath the boulder. As I was waiting for its reappearance, a cry was raised from a watcher aft

that a second snake was close by; glancing in the direction indicated, I saw a young three-foot cobra dart through the water with all the agility of an eel and disappear into a crevice among the submerged rocks. I concentrated on the first snake seen, however, and presently its head and a couple of feet of its body appeared. With my snake stick I pinned it down against a submerged rock, but the rock was slippery and with a few powerful convulsive jerks the reptile threw off the stick. Later the incident was repeated with another large cobra and I was forced to the conclusion that I was merely making myself ridiculous in attempting to hold down such powerful reptiles in their chosen element with nothing but a T-ended stick. I was discussing this afterwards with an Arab who told me that he had succeeded in catching one by a rather diabolical contrivance. He cut a stout V-shaped stick, then drove a long and strong nail into the apex of the fork; when the nail was firmly embedded in the wood, he filed away the head to a needle point. As he planted the stick upon the snake the nail penetrated the backbone, disabling the reptile to some extent and preventing its escape. I made a weapon according to this recipe but during the few hours left to me the opportunity to use it did not occur.

That evening I visited the rocks at the north end of the bay as they would get the full benefit of the setting sun. The morning calm was gone, however, and the waves were pounding along the rocky shore with considerable violence. Everywhere I had been told that these snakes disliked a "rough sea" and leave the water when the wind rises. This is probably correct but at the same time it might be observed that when it is rough it is next to impossible to see down through the water to where the snakes might be; even on a calm day the rippling of the water imparts an appearance of motion to every stick lying on the bottom so that these appear to be wriggling!

When the snakes come out of the lake in the evening they are said to bask *under* the rocks. This is probably correct for then they would be sheltered from the boisterous, on-shore evening wind which tends to cool the surface of the rocks, but they would receive heat radiating from the boulders above and below that had been exposed to the tropical sun all day. At the time of year—mid-May—when I was at Kasanga the evenings were distinctly cool.

Presently one of the boatmen observed a snake lying far in between two boulders but only just above the reach of the breaking waves. I landed and inspected the reptile which merely moved still further in and concealed its head. Its tail was observed to be truncated and rotting and smelt quite offensively. The native explanation was that

its tail had been bitten by one of its companions. Curiously enough only that morning I had shot a Nilotic Monitor Lizard whose tail was completely dead; the monitor was swimming in the lake and its tail was dried and withered but quite possibly might drop off in time.

It was quite impossible to get at the snake in its present position, which was quite a yard in, so I retired another yard and fired a charge of dust-shot from a .22 calibre collecting gun. This caused the reptile to squirm, coil and uncoil. During these convolutions the tail came nearer and I slipped a leather noose over it, then started gently pulling till the tail was clear of the boulder, when I handed the noose-stick to Salimu with instructions to go on pulling slowly while I covered the snake with my T-ended stick until its head should appear. At that very moment the snake came away with unexpected suddenness, Salimu slipping on the wet boulder on which he had been standing, nearly fell, had a sudden vision of the cobra's head raised a foot from the rocks, dropped his noose-stick and fled incontinently. As a matter of fact there was nothing to worry about as I had pinned the snake about midbody with my T-stick, but it held its jaws wide open and Salimu thought that it was about to eject venom after the manner of its terrestrial relatives *Naja* and *Sepedon*. It distended its neck as it reared-up, but the spread was only half as broad as that of a cobra of the same size.

The snake proved to be a five-foot female; had its tail been complete it would have been nearly six feet. Shifting my stick to its neck I re-noosed it behind the head and transferred it to a bag held by Salimu. As we turned to reëmbark in our boat the head and six inches of a cobra's body appeared above the waves about five feet offshore. "Its mate coming to look for it," said the boat boys with the native's gift of a theory for every circumstance. Though we waited some time it did not show itself again.

Two days later we arrived at Kipili which lies about a third of the way up the east coast of the lake. The landing jetties, alongside which the lake steamers tie up, are at the sandy end of a big bay. On landing I made enquiries and was told that aquatic cobras were to be found only on the rocky coast of an island opposite the bay. I hired a dugout and set forth for the island but stopped on the way to examine the possibilities of a stretch of rocks which lay half a mile from the jetties. We saw nothing at this spot and as there was an absence of suitable crevices in which the snakes could hide, I doubt if any but a stray cobra ever visits them. On clearing the headland we met the full force of a strong morning wind. Presently, soaked to the skin, and in momen-

tary danger of being swamped by the big waves, we regretfully abandoned the attempt.

In the evening my dugout was placed on a motor launch and in this way crossed to the island which I was astonished to find, was fully four miles away! Here on a rocky islet only fifty feet in diameter, I disturbed a four and a half-foot cobra which slid down from a shelf beside me and into a crevice between the boulders where I shot it about midbody as it was disappearing into the lapping water. Shifting the gun to my left hand I grabbed the snake's tail and only just in time for it would have disappeared in another second. For twenty minutes I held fast to its tail while the owner strained in the opposite direction and Salimu attempted to pry it free. When at last this was accomplished, and despite the fact that its back had been broken by the dust-shot, no sooner did the poor beast's head come into view than it menaced us with open jaws after the manner of the Kasanga cobra, then it buried its fangs in its own body several times, holding on after each bite with the tenacity typical of the cobras. Quickly I slipped a noose over its head and transferred it to a bag where it was chloroformed. As we continued to scour the rocks, peering into every crevice, a second snake was seen by one of the boat boys but made good its escape before I could reach the spot.

Next day we reached Sumbwa to the north of Kipili; the wharf had been wrecked in a storm and so I was landed by boat upon the beautiful sandy beach. Naturally no cobras could be found in such an environment, but a Catholic missionary, who came off to the *S.S. Liemba,* told me that they were abundant on the rocks at Karema, some seven miles away. Unfortunately we did not remain at Sumbwa long enough to permit of my visiting this place.

Ujiji, five miles south of Kigoma, which is the western terminus of the Central Railway of Tanganyika, is also situated in a sandy bay and therefore without aquatic cobras though they are to be found at Bangwe, the northern headland of the bay. I went there in a dugout on May 28th, but the day was overcast and cold and though the whole morning was spent in searching for them, not a single snake was found. According to the local fishermen, these cobras are rarely seen out in the lake and are only to be encountered in the vicinity of rocks; the same opinion was prevalent in each of the localities visited. It seems probable that at times they do so venture, otherwise they could scarcely have attained their present wide distribution in the lake.

Defence. I came to the conclusion that, out of their element, they are not aggressive nor to be feared as much as the true cobras. Possibly

their sight is not so good on land as under water; it would appear likely that it has undergone modifications to enable them to see clearly the fish on which they subsist.

Venom. There is a widespread superstition prevalent among the fishermen that if a man is bitten in the water he should remain there until treatment in the shape of a water weed is brought to him. If he leaves the water he will rapidly succumb to the effects of the poison though if returned to the water for treatment hopes for his recovery may be entertained!!

Parasites. Strangely enough, three ticks were found about the head of one of these aquatic snakes.

Naja melanoleuca Hallowell

Naia haie var. *melanoleuca* Hallowell, 1857, Proc. Acad. Nat. Sci. Philad., p. 61: Gaboon, West Africa.

1 (M. C. Z. 30405) Kitungulu, Urungu. 15. v. 30.
1 (M. C. Z. 30406) Ukerewe Id., Lake Victoria. vi. 30.
1 (M. C. Z. 30407) Entebbe, Lake Victoria. 27. vi. 30.
1 (M. C. Z. 30408) Kampala, Uganda. vi. 30.
1 (M. C. Z. 30409) Mabira Forest, Uganda. 1. vii. 30.

Distribution. Already recorded from Ukerewe Island by Sternfeld.

Native name. *Mufi* (Kirungu).

Variation. Midbody scale-rows 19; ventrals 206–210; anal entire; subcaudals 58–64; labials 7, the 3rd and 4th entering the orbit; postoculars 3; anterior temporal 1. In all of which the series is normal.

Measurements. The largest snake, a male from Kitungulu, measures 1,792 (1,486+306) mm.

Parasites. Nematodes (*Kalicephalus sp.*) and cestodes (*Ophiotaenia theileri*) were in its stomach. The latter were reported on by Baer (1933, Revue Suisse Zoöl., p. 80) as from *N. haje* from "Uzungwe" a misreading of my label "Kitungulu, Urungu."

Habitat. The Kitungulu snake, which was about to slough, was resting in a cavity in an enormous decayed tree trunk that was lying in a patch of swampy primary forest near the river bank. After we had been chopping at this log for nearly half-an-hour I left Salimu to finish it while I went in search of a more remunerative one. Salimu subsequently stated that, shortly after my departure, this six-foot snake emerged from one end of the log and was making off when he stunned it with a blow, then bagged it. When he arrived in camp with it a couple of hours later it had fully recovered and was quite lively.

The small Ukerewe Island specimen was taken just before my arrival by Père A. Conrads who very kindly presented it to me for a record. Beneath a massive piece of rock near the Lake shore I found large quantities of cast skin and concluded that a cobra, or cobras, dwelt in the hole of which these were in the entrance. On the other hand when I related this to Père Conrads he told me that the natives in that direction reported losing cattle from time to time alleging that they were bitten by a big snake. This sounds more like the work of a mamba which Sternfeld has recorded from the island.

I discovered the Entebbe snake beneath a log lying within ten feet of the lake shore and just as it was moving off, pinned it down with the handle of my frogging-net. Like all the other members of this series its stomach was empty.

Naja nigricollis Reinhardt

Naja nigricollis Reinhardt, 1843, Dansk. Vidensk. Selsk. Skrift, **10**, p. 269, pl. iii, figs. 5 and 7: Guinea, West Africa.

1 (M. C. Z. 30410) Kilimatinde, Ugogo. 26. xi. 29.
2 (M. C. Z. 30411–2) Unyanganyi, Turu. 4–7. xii. 29.
3 (M. C. Z. 30413–5) Mangasini, Usandawi. 12–14. xii. 29.
1 (M. C. Z. 30416) Kitungulu, Urungu. 14. v. 30.

Distribution. At Mpwapwa I examined a very large Black-necked Cobra of the grey black type which had been killed in a house in the town. The natives of Mwaya aver that the species occurs there, they are probably correct. Recorded by Sternfeld from Dar es Salaam, Victoria Nyanza etc.

Native names. *Nundusu* (Kikinga); *mufi* (Kirungu, but generic only).

Variation. Midbody scale-rows 19; ventrals 196–205; anal entire; subcaudals 57–64; labials 6, only the 3rd entering the orbit; anterior temporals 2. In all of which the series is normal.

Coloration. Above, black or smoke-grey; below, white, grey or black; all have a black throat and "neck" which in most of these specimens is followed by an area of pink more or less mottled with black.

Measurements. Largest male (No. 30415) measures 1,441 (1,195+246) mm.; biggest female (No. 30410) measures 1,584 (1,312+272) mm.

Breeding. Four of the snakes taken in December are very young; they range in length from 347 to 372 mm.

Diet. Only one specimen, a Mangasini snake, held food, this was a frog (*Rana adspersa*).

Parasites. Ticks were collected on the cobra from Kilimatinde, and nematodes (*Kalicephalus sp.*) in the Kitungulu snake.

Habitat. While at Kilimatinde I visited the old German fort which has been in ruins ever since the war. When I last saw it in 1926, it was so choked with vegetation that one could hardly get about in either courtyard or rooms. Recently the Church Missionary Society had the undergrowth cleared and commenced to renovate one of the buildings for use as a temporary hospital. On entering a cell-like room in this ruin I noticed a foot of cobra's tail protruding from a hole in the wall, creeping forward, I seized it, and at the same time placed my forked stick lightly on the portion nearest the hole. Naturally the snake pulled in an endeavor to withdraw itself completely into the wall and all I had to do was to keep up a gentle strain relaxing at intervals as one might play a fish. As was to be expected, after finding all its attempts to advance futile, the reptile reversed and started to come out backwards; several times by gentle pressure of the stick I checked its efforts at accelerated withdrawal. Two feet of snake were soon in sight, three, four and five followed and I was just beginning to wonder what sized snake I had to deal with when a second later its head came into view and was pinned down before it had a chance to spit; later I ascertained that the length was five and a half feet. Taking the cobra outside I put it in a bag from which it promptly escaped but instead of attacking, it made off but was recaught within a few yards. As I was returning it to the bag, it chewed on the latter so doggedly that I had much difficulty in getting it in; venom dripped from its fangs and trickled in beads down the bag and upon my fingers. Despite this abundance of venom the snake was much emaciated and I concluded that it had been aestivating through the exceptionally long dry season and had only recently emerged and set out in search of food.

At Unyanganyi a young smoke grey cobra with an all-black collar extending to the back of its neck, came out from a hole at the base of a baobab tree just as a heavy shower on the 5th had ceased. Before it could get back I caught it and though it spat several times as I was securing it, the venom fell short.

The Kitungulu snake crossed my path just after sunset and entered dry orchard forest five miles west of Kitungulu.

Dendraspis angusticeps (Smith)

Naia angusticeps A. Smith, 1849, Illus. Zoöl. S. Africa, **3**, pl. lxx: Natal, South Africa.

Aggressiveness. Curiously enough no mambas were seen during the whole trip. As doubts are sometimes thrown upon the aggressiveness of mambas it seems worth while recording the following accounts, both of which were given to me by gentlemen who were keenly interested in natural history. In neither case is the evidence absolutely convincing that the snake was the aggressor though the probability is so in both, in the first story the snake may have assumed that it was itself about to be attacked.

A small boy, child of a native squatter on the estate of my informant, Mr. Hardy, was herding his father's flock when his attention was attracted by the bleating of a goat. Hurrying in the direction of the sound he saw a mamba on, or wrapped about (?) the goat which it was biting; the snake then left the goat and came straight for the child and struck him with the result that the little goatherd died the same day.

Mr. Fenwick of Miritini, near Mombasa, told me that the son of his neighbor, an Arab planter, was playing near the house to which he rushed back screaming and calling out that he had been attacked and bitten three times by a large snake. This child also died on the same day that he was bitten. Details of the story which I have since forgotten pointed strongly to a mamba as being the species of snake concerned.

VIPERIDAE

Causus rhombeatus (Lichtenstein)

Sepedon rhombeatus Lichtenstein, 1823, Verz. Doubl. Mus. Berlin, p. 106: No locality.

♂ ♀ (M. C. Z. 30417–8) Ilolo, Rungwe. 15. iii. 30.
♂ (M. C. Z. 30419) Kampala, Uganda. vi. 30.

Distribution. Recorded from Bagamoyo and Bukoba by Tornier but these identifications may have been erroneous as they are not given by Sternfeld who records it from Ukerewe Island.

Native name. Kitumbi (Kinyakusa but very similar to their name for *Vipera superciliaris*).

Variation. Midbody scale-rows 19; ventrals 141–151; anal entire; subcaudals 22–29; labials 6.

Measurements. The Kampala male measures 438 (400+38) mm., the Ilolo female 616 (550+66) mm.

Diet. A toad (*Bufo r. regularis*) was present in the stomach of the Ilolo female.

Venom. I was told that, just before the war, a European child had been bitten and died of snake-bite at the Rungwe Mission, Ilolo. That it was a Rhombic Night Adder seems probable though Sternfeld has recorded *Causus defilippii* as occurring at Tukuyu which is only ten miles from Ilolo.

Causus resimus (Peters)

Heterophis resimus Peters, 1862, Monatsb. Akad. Wiss. Berlin, p. 277, pl. —, fig. 4: Gebel Ghule, Senaar, Sudan.

♀ (M. C. Z. 30420) Ukerewe Id., Lake Victoria. vi. 30.

Distribution. Recorded from Dar es Salaam by Sternfeld and from Lake Tanganyika by Boulenger.

Variation. Midbody scale-rows 21; ventrals 143; anal single, subcaudals 18; labials 6.

Coloration. The uniformly plumbeus appearance of the preserved snake gives a poor idea of the wonderfully vivid, yet velvety, green color of the living night adder. It is one of the most beautiful of East African reptiles.

Measurements. Total length 424 (390+34) mm.

Causus defilippii (Jan)

Heterodon defilippii Jan, 1862, Arch. Zoöl. Anat. Phys., **2**, p. 225: Africa.

1 (M. C. Z. 30421) Mpwapwa, Ugogo. 23. xi. 29.
1 (M. C. Z. 30422) Kitungulu, Urungu. 16. v. 30.

Distribution. According to Sternfeld, Defilippi's Night Adder also occurs at Bagamoyo, Dar es Salaam, Tukuyu and in Ugogo.

Variation. Midbody scale-rows 17; ventrals 114–116; anal single; subcaudals 14–15; labials 5–6; the former resulting from a fusion of the 3rd and 4th making the 3rd, instead of the 5th, labial the largest; the frontal is equal to, or *longer*, than its distance from the end of the snout.

Breeding. Both specimens are very young being only 234 (212+22) and 155 (142+13) mm. respectively.

Habitat. I found the Mpwapwa snake under the same rotting tree

stump in sandy soil where I took *Rhinocalamus dimidiatus.* The Kitungulu reptile was driven out by the fire which we set to a pile of refuse in a native garden.

Vipera superciliaris Peters

Vipera superciliaris Peters, 1854, Monatsb. Akad. Wiss. Berlin, p. 625: Cape Delgado, Mozambique; 1882, Reise nach Mossamb., **3**, p. 144, pl. xxi; Pfeffer, (1892) 1893, Jahr. Hamb. Wiss. Anst., **10**, p. 89: Quilimane, Mozambique; Boulenger, 1915, Proc. Zoöl. Soc. London, p. 638: "German East Africa at Cape Delgado"; Cott, 1928, Proc. Zoöl. Soc. London, p. 934: Charre and Fambani, Mozambique.

2 (M. C. Z. 30423–4) Mwaya, Lake Nyasa. 1–8. iii. 30.

Distribution. These are presumably the sixth and seventh recorded examples of the rare Yellow-browed Viper. They constitute the first record for Tanganyika Territory for Boulenger was in error in 1915 when he transferred Cape Delgado from Mozambique to German East Africa.

Native name. Katumbi (Kinyakusa, very similar to that applied to *Causus rhombeatus*).

Variation. Both agree with the type in the number of midbody scale-rows 27; but they have 140 instead of 142 ventrals; subcaudals 40 as in the type with which they agree in other respects. It would appear as if the range of variation is small in this ancient, isolated, and most southerly member of its genus in Africa.

Coloration in life. These examples were richer and even more handsome than the specimen figured by Peters.

Measurements. Both males, the larger 488 (425+63) mm., the smaller 283 (245+38) mm., both being surpassed by the type which was 570 mm. The Banyakusa at Mwaya probably confuse this snake with the Puff Adder for they told me that it attains the size of a man's arm and was not uncommon.

Diet. The larger held a rat in its stomach and the smaller a frog (*Phrynobatrachus acridoides*). All that we know of the habits of this snake in life is given by Cott, who writes: "Several specimens of a very rare snake, *Vipera superciliaris,* which is known locally as "Tandaruma," were taken. This species, which it appears has only been found once previously, is for some reason extremely difficult to keep in captivity; specimens from Charre and Fambani invariably refused food, and all died within a week or two of being captured."

I would suggest that the early deaths imply that the snakes had

been internally injured by their captors if these were natives, for a blow on the spine or congestion caused by being carried in a split stick would render a snake indisposed to feed and cause its death apart from malnutrition. On the other hand, though their refusal of food could not cause death in so short a time, it may be that these vipers share a disinclination to feed in captivity with their European ally *Vipera b. berus*.

Bitis arietans (Merrem)

Vipera arietans Merrem, 1880, Vers. Syst. Amphib., p. 152: Cape of Good Hope.

1 (M. C. Z. 30425) Mpwapwa, Ugogo. 22. xi. 29.
3 (M. C. Z. 30426) Mangasini, Usandawi. 13. xii. 29.
1 (M. C. Z. 30427) Igale, Poroto Mtns. 30. iv. 30.
3 (M. C. Z. 30428) Ukerewe Id., Lake Victoria. 14. vi. 30.
1 (M. C. Z. 30429) Kampala, Uganda. vi. 30.

Distribution. Recorded by Sternfeld from Kitopeni; Dar es Salaam; Mpwapwa; Lake Tanganyika; Bukoba and Ukerewe Island; by Boulenger from Lake Nyasa.

Measurements. The largest male was from Ukerewe Island and measured 1,151 (1,020+131) mm. or 45⅜ inches, surpassing my largest (Kilosa) record by two inches. While such big snakes are extremely rare at Kilosa they appear to be of normal occurrence on Ukerewe for this was only one of three large Puff Adders—all males over 42½ inches—brought in together slung on a pole. Several others of similar dimensions were also offered for sale but not purchased. The midbody circumference of the largest male was 190 mm.

Diet. Stomach contents consisted of:—(1) a rat (*Rattus r. kijabus*) at Mangasini; (2) a rat (*Rhabdomys p. dimidiatus*) at Igale; (3) a rodent in one of the Ukerewe Island snakes.

Parasites. Numerous nematodes (*Ophidascaris sp. & Thubunea sp.*), some of extraordinary length, were found in the Ukerewe specimens.

Bitis gabonica (Duméril & Bibron)

Echidna gabonica Duméril & Bibron, 1854, Erpét. Gén., **7**, p. 1428, pl. lxxxb: Gaboon, West Africa.

♂ (M. C. Z. 30430) Mbuyu near Kampala, Uganda. vi. 30.

Variation. Midbody scale-rows 34; ventrals 128; anal single; subcaudals 30; labials 14.

Measurements. Total length 355 (320+35) mm.
Diet. A mouse (*Leggada sp.*) was in its stomach.

Atheris barbouri Loveridge

Atheris barbouri Loveridge, 1930, Proc. N. Eng. Zoöl. Club, **11**, p. 107: Dabaga, Tanganyika Territory.

3 (M. C. Z. 29055–7) Dabaga, Uzungwe Mtns. 1. i. 30.
6 (M. C. Z. 30431–5) Madehani, Ukinga Mtns. 13–18. ii. 30.

Distribution. In addition to these localities I was shown a specimen taken near Mufindi at the southern end of the Uzungwe Mountains and a missionary at Tandala in the Ukinga Mountains described one of these tree vipers which she had killed in her garden the week previous to my arrival, but a species which she had no recollection of having seen before during her many years of residence there.

Native names. Moma (Kikinga); *mboma* (Kirungu). Both these forms are used in Kiswahili for the Puff Adder, in all probability they are applicable to any viper.

Variation. Since the publication of the original description which was written in the field and based on the three Dabaga snakes the additional data available from a study of the Madehani series permit of a slight extension of the range of variation. As all five species of the genus are represented in the collection of the Museum of Comparative Zoölogy I have tabulated the available data as regards the more important scale-counts most of which have been considerably increased since the publication of the Catalogue of Snakes. Schmidt has suggested that Boettger's *A. laeviceps* from Boma, Belgian Congo might be revived as a race of *squamigera* but for the purposes of this tabulation they are treated as one species.

Species	*Midbody scale-rows*	*Ventrals*	*Anal*	*Sub-caudals*	*Labials*	*Scales round orbit*	*Scales across occiput*
A. barbouri	19–23	114–128	1	14–22	5–6	8–13	8–9
A. ceratophorus	21–25	142–152	1	54–56	9–11	16–17	8–11
A. nitschei	25–32	141–162	1	35–52	9–12	12–15	8–10
A. chloroechis	25–36	154–165	1	48–62	9–13	15–20	9–14
A. squamigera	15–25	153–173	1	45–65	7–12	10–18	6–9

From the above data I conclude that *squamigera* is the most primitive species, it is also the most widely distributed, and that the others are offshoots of which *A. barbouri* is an end form occurring far to the

southwest of any other members of the genus. Perhaps it might be as well to remark that in reality the members of the genus are much more distinct than the tabulated data might lead one to suppose.

Coloration. See Habitat.

Measurements. The largest of four males measures 352 (315+37) mm.; the type still remains the largest of the five females being 369 (335+34) mm.

Sex. Each specimen was carefully sexed and no overlapping of scale-counts occurs in this small series.

♂ ventrals	114–118;	subcaudals	20–22.
♀ "	119–128;	"	14–19.

Breeding. A female taken at Madehani on 13. ii. 30 held ten eggs measuring 10 x 6 mm. Other females brought in on the 14th and 18th respectively also each held ten very small eggs, while a fourth female held none on the 18th. One snake was very young and only measured 164 (148+16) mm. when found in the road on the 19th.

Diet. A large earthworm was taken from the stomach of the young snake to which I have just referred.

Habitat. A woman had dug up a pair when hoeing the ground for planting, I imagine that they were concealed among sods such as litter the gardens. She brought them alive. The male had rather indistinct markings above and was uniformly olive below. The female had a chain of rhombs down the back, was olive below but chequered with black posteriorly.

Atractaspis irregularis (Reinhardt)

Elaps irregularis Reinhardt, 1843, Dansk, Vidensk. Selsk. Skrift., **10**, p. 264, pl. iii, figs. 1–3: Gaboon, West Africa.

1 (M. C. Z. 30275) Entebbe, Lake Victoria. 28. vi. 30.

Distribution. Recorded by Boulenger from Uganda and by Sternfeld from the Zanzibar coast.

Affinities. In view of the fact that we now know so many African *Atractaspis* have extensive ranges across Africa from coast to coast as is the case with *irregularis*, *bibronii* and *aterrima*, and also that they exhibit a greater degree of variation than was originally supposed, it seems very possible that *A. bipostocularis* Boulenger from Mt. Kenya may ultimately have to be united with *irregularis*. There are two examples of other species in the collection of the Museum of Compara-

tive Zoölogy which possess a single postocular on one side of the head and a pair on the other!

Variation. This Entebbe specimen agrees perfectly with the description of *irregularis* given in the Catalogue of Snakes except that, instead of 25–27, it possesses 23 midbody scale-rows. Ventrals 229; subcaudals 24; labials 5, the 3rd and 4th entering the eye; postocular 1.

When passing through Nairobi, I took the opportunity of reëxamining the Nairobi Museum specimen No. I 92 without locality which agrees with the present specimen in possessing 23 midbody scale-rows. It is, however, a typical *irregularis* in every other respect except that the 4th lower labial instead of the 3rd is the largest. The 4th lower labial being largest is, together with the two postoculars, the key character distinguishing *bipostocularis* referred to above.

Measurements. The Entebbe snake is very young with umbilical scutes still unhealed, it measures 247 (230+17) mm.

Diet. Stomach contents consisted of a *Leptotyphlops conjuncta* though the identification is an assumption for the head of the prey is completely digested away, what remains measures 127 mm.

Atractaspis conradsi Sternfeld

Atractaspis conradsi Sternfeld, 1908, Sitzb. Ges. Naturf. Freunde Berlin, p. 94: Ukerewe Island, Tanganyika Territory; Roux, 1910, Ann. Zoöl. Suisse, p. 99: Bukoba, Tanganyika Territory; Sternfeld, 1912, Wiss. Ergebn. Deutsch-Zentral-Afrika-Exped., **4**, p. 278: Lake Kivu, Belgian Ruanda; Boulenger, 1915, Proc. Zoöl. Soc. London, p. 640: Entebbe, Uganda.

Distribution. Ukerewe Island was visited with the express purpose of securing a series of these burrowing vipers; unfortunately, however, the rainy season was long past and the countryside already somewhat parched so that I failed to obtain any specimens of *conradsi* during my ten days' stay. Through the courtesy of Père Conrads, the original discoverer of this snake, I was permitted to examine his recent collections among which I found a young *Atractaspis* of considerable interest which is undoubtedly referable to *bibronii,* of which *rostrata* is a synonym.

The interest lies in the fact that it shows that *bibronii* occurs in three of the localities from which *conradsi* has been reported, viz. Ukerewe Island, Bukoba and Entebbe.

Affinities. The only character which differentiates *A. conradsi* from *A. bibronii* is that the anal and subcaudals of the former are divided or paired while in *bibronii* they are single. In view of the variation

shown by West African *Atractaspis* it remains to be seen whether it is of specific importance in the present instance.

The original description of *conradsi* only occupies four lines and a translation reads as follows:—"Near *A. irregularis* from which it is distinguished by a somewhat pointed snout and by the 23 scale-rows. Color dark blackish-brown. Length 50 cm. Tail 2.8 cm. 1 Ex. V = 257. Sq = 23. Sc = 23. Ukerewe Id., D. O. A. Conrads." When recording the Kivu specimen in 1912, he added that the sutures between the prefrontals and nasals are of practically the same length; symphisial is separated from the anterior chin-shields; 3rd lower labial enormous; anal and subcaudals up to the last, divided. Roux also gives the data of his snake.

Variation. In the young *bibronii* from Ukerewe Island in Père Conrads' collection, the snout is pointed; there is a single postocular in contact with a large temporal; 1st lower labial on the left side reaches the median line of the throat, its fellow on the right does not but is well-separated, if one assumes that the abnormality is of the right side, then, if normal, the labials would be in contact; midbody scale-rows 25; ventrals 223, anal entire, subcaudals single 21; upper labials 5 of which the 4th is much the largest. Thus though the snake is undoubtedly *bibronii* it will be observed that only in the matter of the anal and subcaudals is it distinct from *conradsi* for it is probable that when more material is available, *conradsi* will be found to have a midbody scale count of from 23–27 like the allied species.

Atractaspis bibronii Smith

Atractaspis bibronii A. Smith, 1849, Illus. Zoöl. S. Africa, **3**, pl. lxxi: Eastern districts of Cape Colony, South Africa; Schmidt, 1923, Bull. Am. Mus. Nat. Hist., **49**, p. 138: Garamba, Belgian Congo.

Atractaspis rostrata Günther, 1868, Ann. Mag. Nat. Hist. (4), **1**, p. 429, pl. xix, fig. 1: Zanzibar; Barbour & Loveridge (part), 1928, Mem. Mus. Comp. Zoöl., **50**, p. 137; Dar es Salaam and localities in the Uluguru Mountains, Tanganyika Territory.

Affinities. The Museum of Comparative Zoölogy having very recently obtained examples of *bibronii* from both southwest and southeast Africa, I have taken the opportunity of checking the conclusions of Werner, which were followed by Schmidt though the latter had no southern material for study. I fully concur with these authors and fail to find any characters whereby one may distinguish *rostrata* (East Africa) from the older *bibronii* (South Africa). This brings into line

Sternfeld's records of both "species" which he reports from various localities in Tanganyika Territory. Roux has recorded *rostrata* from Bukoba and Boulenger from Lake Nyasa and Uganda. See remarks under *Atractaspis conradsi*.

Atractaspis aterrima Günther

Atractaspis aterrima Günther, 1863, Ann. Mag. Nat. Hist. (3) **12**, p. 363: West Africa; Boulenger, 1915, Proc. Zoöl. Soc. London, p. 640: Uganda and West Africa, from the Gold Coast to the Niger.

Atractaspis rostrata (part) Barbour & Loveridge, (*nec.* Günther), 1928, Mem. Mus. Comp. Zoöl., **50**, p. 137; part Nyange series only.

♂ (M. C. Z. 23466) Nyange, Uluguru Mtns., 11. x. 26.

Distribution. This record involves a considerable extension of range to the eastward for hitherto Uganda was the most easterly record.

Variation. This specimen is one of a series of three snakes from Nyange which were referred by Barbour & Loveridge to *rostrata* (=*bibronii*). While the other two are referable to *bibronii,* of which *rostrata* is now considered a synonym, this snake must be referred to *aterrima* for it possesses 27 ventral scutes more than any of the others.

In connection with checking the alleged differences between *bibronii* and *rostrata* my attention was attracted to this snake by its rounded snout which definitely separated it from all the sharp-snouted *bibronii* in the collection. On comparing it with the description of *aterrima* I found it to agree in all respects except that the midbody scale-rows were 23 instead of 19–21 as recognised for *aterrima.* I feel confident that the range for *aterrima* should be increased to 19–23.

This specimen has 276 ventrals, an undivided anal and 25 unpaired subcaudals. This correction makes it necessary for the range of ventrals in *bibronii* to revert to their former range of 221–260, *not* 276.

Measurements. Total length 559 (525+34) mm.

Atractaspis microlepidota Günther

Atractaspis microlepidota Günther, 1866, Ann. Mag. Nat. Hist. (3), **18**, p. 29, pl. vii, fig. 3: Type locality unknown. "Probably West Africa" *errore;* Loveridge, 1916, Journ. East Afr. & Uganda Nat. Hist. Soc., p. 87: No locality, probably Kenya.

Atractaspis phillipsi Barbour, 1913, Proc. Biol. Soc. Wash., p. 148: Singa, Senaar province, Sudan.; Boulenger, 1915, Proc. Zoöl. Soc. London, p. 658: Key to species.

Atractaspis magretti Scortecci, 1929 (1928), Atti. Soc. Italia. Sci. Nat. Mus. Civ. Milano, **67**, p. 308, fig. 6: Mandafena & Monte Dongolla, Erythraea.

1 (M. C. Z. 29999) "Kenya Colony."

Distribution. *A. microlepidota* has been recorded by Boulenger from Lake Tanganyika and by Sternfeld from Lamu, Kenya Colony.

Variation. The specimen listed above, whose full data is given in the 1916 citation, was originally I 93 in the collection of the East Africa and Uganda Natural History Society by whom it was given to me to bring back to the Museum of Comparative Zoölogy.

I have carefully compared it with the figure of Günther's type and find them in full agreement except that it possesses two postoculars on one side of the head, but only one, like the type, on the other.

I have also compared the type of *A. phillipsi* with the figure and with this specimen and find that *phillipsi* only differs in that the 4th labial alone enters the orbit, instead of the 3rd and 4th in *microlepidota*. However the two sides of the head in *phillipsi* are not entirely alike for on the left side of the head the 3rd labial very nearly enters being separated by a space and not a scale. Except for some very trifling variation in the relative proportion of some of the head scales the three snakes are in full agreement.

A. phillipsi and *A. magretti* undoubtedly came to be described on account of Boulenger's erroneous key in the Catalogue of Snakes, **3**, p. 512 and repeated in the 1915 citation given above. These keys ignore the scale, cut off from the upper part of the 5th labial which Barbour rightly calls "a single large anterior temporal" for in other species the analogous scale is so-called by Boulenger himself, in some specimens it is semi-posterior to the postocular, in others almost below it; it is clearly shown in Günther's figure of the type. In ignoring it Boulenger states "temporals small" as a major division in his key as opposed to "Postocular in contact with a large temporal."

GEKKONIDAE

Paragonatodes quattuorseriatus (Sternfeld)

Gonatodes quattuorseriatus Sternfeld, 1912, Wiss. Ergebn. Deutsch-Zentral-Afrika-Exped., **4**, p. 202, pl. vi, fig. 1: Kissenje; Uvira; Lake Kivu, etc., Belgian Ruanda.

♂ (M. C. Z. 30436) Mpwapwa, Ugogo. 22. xi. 29.

Distribution. The Mt. Kenya specimen of *P. africanus* has since been referred to *quattuorseriatus* by Nieden. One would have expected

the Mpwapwa lizard to be referable to *africanus* which occurs on the Usambara Mountains (its type locality), the Uluguru Mountains, Mt. Meru, and Kilimanjaro (loc. incert); this is not the case, however.

Variation. The Mpwapwa gecko has 7 upper labials, 5 lower labials and 7 preanal pores. The two species are distinguished as follows:—

5–6 upper; 5–6 lower labials; 7–8 preanal pores . . . . *quattuorseriatus*
6–7 upper; 7–8 lower labials; 8–12 preanal pores . . . *africanus*

One might be tempted to suppose that they are not specifically distinct were it not for the fact that Sternfeld based his description on nine cotypes. Of *africanus* we have over a score of topotypes in the Museum of Comparative Zoölogy and none of these intergrade. The Mpwapwa gecko has been compared with one of Sternfeld's cotypes also in this collection.

Coloration. The coloration of the Mpwapwa gecko is identical with that of Usambara *africanus;* according to Sternfeld the coloration of *quattuorseriatus* is the same as that of *africanus* "but brighter."

Measurements. Total length 60 (36+24) mm.

Habitat. Taken in sandy debris among the rotting roots of a fallen tree lying fifty feet from a small stream but in dry and dusty ground. It is a rain-forest form surviving in a locality which is undergoing desiccation.

HEMIDACTYLUS MABOUIA (Moreau de Jonnés)

Gecko mabouia Moreau de Jonnés, 1818, Bull. Soc. Philom. Paris, p. 138: Antilles and adjacent mainland.

♀ (M. C. Z. 30437) Bagamoyo. 11. xi. 29.
♀ (M. C. Z. 30438) Mangasini, Usandawi. 13. xii. 29.
♂ (M. C. Z. 30439) Mwaya, Lake Nyasa. 1. iii. 30.

Distribution. Also seen on Mombasa Island and at Changamwe, Tanga, Dar es Salaam and Kilimatinde.

Native names. Zirambi (Kisandawi); *kanakipili* (Kinyakusa).

Variation. Male with 50 preanal pores; 9–12 rows of conical dorsal tubercles; 7–8 subdigital lamellae under the median digit.

Coloration. Grey on stem of cultivated banana at Changamwe; white on whitewashed wall of Hotel Africa, Dar es Salaam.

Enemies. Two were recovered from the stomachs of Spotted Wood Snakes (*Philothamnus s. semivariegatus*) at Bagamoyo.

Habitat. Numerous on walls of a deserted Arab building at Bagamoyo; on rocks in dry river bed at Kilimatinde; on rocks on kopjes at Mangasini, and very abundant on the trunks of trees forming the main avenue at Mwaya, a habitat which they share with *Agama atricollis.*

HEMIDACTYLUS PERSIMILIS Barbour & Loveridge

Hemidactylus persimilis Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 140, pl. iv, figs. 1 and 3: Dar es Salaam, Tanganyika Territory.

♂ (M. C. Z. 30440) Miritini, Kenya Colony. 30. x. 29.
5 ♀ ♀ & eggs (M. C. Z. 30441–5) Bagamoyo. 11. xi. 29.
Young (M. C. Z. 30446) Morogoro, Ukami. 20. xi. 29.

Variation. Male with 34 preanal pores; 12–17 rows of conical dorsal tubercles; 5 subdigital lamellae under the median digit.

Breeding. Each of the Bagamoyo females clearly showed a pair of ovarian eggs through the abdominal skin, at the same time and place fifteen pairs of eggs were taken, the units of each pair, unlike those of *H. mabouia*, were separate in each instance; both geckos and eggs were in the *mcuti* thatch of collapsed huts in native rice fields.

Enemies. One gecko was recovered from the stomach of a Green Snake (*Chlorophis hoplogaster*) at Bagamoyo.

Habitat. The Miritini male was taken under a piece of burnt bark and was black in consequence; the young Morogoro gecko was on the stem of a banana close to some huts.

HEMIDACTYLUS TROPIDOLEPIS SQUAMULATUS Tornier

Hemidactylus squamulatus Tornier, 1897, Die Kriechthiere D-O-A, p. 10: Kakoma, Ugundu, Tanganyika Territory.

Hemidactylus tropidolepis Barbour & Loveridge (non Mocquard), 1928, Mem. Mus. Comp. Zoöl., **50**, p. 142: Near Kilindini, Kenya Colony.

♂ (M. C. Z. 20447) Near Kilindini, Kenya Colony. 29. x. 29.

Affinities. Recently Parker (1932, Proc. Zoöl. Soc. London, p. 342) with fresh Somaliland material has raised the question of the distinctness of *squamulatus,* long considered a synonym of *tropidolepis* and considers the latter distinct on the basis of the fewer preanal pores 7–8 as against 13–19 in *squamulatus.*

Variation. Male with 15 preanal pores; 3 pairs of chin-shields.

Measurements. Total length 65 (36+29) mm.

Habitat. Obtained at the same spot as the two examples collected in 1926, viz. on the mainland opposite Kilindini harbour. Apparently the species is decidedly rare for I spent some hours in unavailing search both before and after this gecko was found between some dead palm fronds piled upon a stump in a native garden.

HEMIDACTYLUS WERNERI WERNERI Tornier

Hemidactylus werneri Tornier, 1897, Arch. Naturg., **63**, p. 63: Dalalani, Tanganyika Territory.

Hemidactylus werneri werneri Loveridge, 1929, U. S. Nat. Mus. Bull. No. 151, p. 44: Itende (not Hende), Dodoma, Tanganyika Territory.

♂ (M. C. Z. 30464) Mpwapwa, Ugogo. 23. xi. 29.
♀ (M. C. Z. 30465) Masiliwa, Turu. 10. xii. 29.
♀ (M. C. Z. 30466) Maji Malulu, Usandawi. 10. xii. 29.
♀ (M. C. Z. 30467) Mangasini, Usandawi. 13. xii. 29.

Variation. Upper labials 6–7; lower labials 5–7; lamellae under median digit 4–7 pairs.

Measurements. None exceed in size specimens previously recorded.

Habitat. The Mpwapwa gecko was taken under a rotting tree stump in sandy soil forming the bank of a dry watercourse. The Masiliwa specimen from beneath the bark of a fallen tree at 9 a.m. The one from Maji Malulu at dusk, close to a hole into which it attempted to retreat. At Mangasini, just after my tent had been pitched, I captured a half-grown gecko which was running up the inside of my tent; presumably it had been disturbed during the hoeing-over of the camp site, though it is feasible to suppose that it may have been brought in the tent from the last camp at Maji Malulu. I mention this in view of the fact that no other *werneri* were taken during our week's stay at Mangasini.

HEMIDACTYLUS WERNERI ALLUAUDI Angel

Hemidactylus alluaudi Angel, 1923, Bull. Mus. d'Hist. Nat. Paris, p. 490: Bura, Kenya Colony.

Hemidactylus werneri alluaudi Loveridge, 1929, U. S. Nat. Mus. Bull. No. 151, p. 46.

As I was passing through Paris, through the courtesy of Mons. F. Angel, I was afforded the opportunity of examining the type of this gecko which confirmed my views as to its very close affinity with *H. werneri* Tornier.

The holotype is a female, distended with ova, possessing 62 midbody scale-rows and 16 rows of enlarged and strongly keeled scales across the back though these are not more strongly keeled than in *werneri;* upper labials 6 (it is a matter of opinion whether they can be considered 7 or 8 as the posterior ones are scarcely differentiated); 5 lower labials; 5 pairs of lamellae under the median digit, the distal pair undivided. The coloration is the same as in *werneri* but is much faded.

There remains therefore, the one character of the mental separating the chin-shields which differentiates this form from typical *werneri* where the chin shields are in contact.

Hemidactylus brookii Gray

Hemidactylus brookii Gray, 1844, Zoöl. Erebus and Terror, pl. xv, fig. 2: "Australia; Borneo."

3 (M. C. Z. 30448–50) Saranda, Ugogo. 18. xi. 29.
20 (M. C. Z. 30451–60) Ukerewe Id., Lake Victoria. 10–19. vi. 30.
3 (M. C. Z. 30461–3) Kampala, Uganda. vi. 30.

Variation. Males with 30–34 preanal pores, average 31.

Measurements. The largest of 14 males (No. 30460) measures 125 (65+60) mm. though the tail is reproduced; the largest of 12 females is 122 (62+60) mm. One Saranda gecko is very young being only 58 (28+30) mm.

Habitat. At Saranda, where *Pachydactylus boulengeri* was found on the walls of the houses, these geckos were taken beneath the bark of fallen trees and in a hole in a tree-trunk. At Ukerewe Island, in the absence of the house geckos *H. mabouia* and *P. boulengeri,* this species was abundant on the walls of the mission outbuildings and my first specimen was taken at 10 p.m. on the day of arrival on a post of the verandah at the Mission. At Morogoro, where both *H. mabouia* and *H. brookii* occur the latter lives in the bush or under rubbish while *H. mabouia* occupies houses and large trees. Lang has already pointed out that *brookii* is the common house gecko in the Congo.

Lygodactylus capensis capensis (Smith)

Hemidactylus capensis A. Smith, 1849, Illus. Zoöl. S. Africa, **3**, pl. lxxv, fig. 3: Kaffirland and districts north of Cape Colony.

4 (M. C. Z. 30487–90) Masiliwa, Turu. 10. xii. 29.

Variation. After comparison with South African *capensis* I fail to find any differences sufficiently marked to justify one in differentiating East African specimens. Males with 7 preanal pores; upper labials 6–8; lower labials 6–7; 4 pairs of lamellae under the longest digit.

Coloration. The grey color and markings of these geckos so closely matched the lichen-covered bark on which they were found as to render their detection difficult.

Measurements. The larger of two males measures 65 (32+33) mm.;

the larger of the females 61 (29+32) mm. The smaller is very young being 36 (20+16) mm.

Habitat. Taken on the trunks of trees growing in open woodland.

Lygodactylus stevensoni Hewitt

Lygodactylus stevensoni Hewitt, 1926, Ann. Natal Mus., **5**, p. 445, pl. xxv, figs. 3–4: Khami Ruins, S. Rhodesia.

♂ (M. C. Z. 30491) Nyamkolo, N. Rhodesia. 9. v. 30.

Distribution. Geckos, which appeared to be specifically identical with this species, were seen on the Stevenson Road near Ikombo, N. Rhodesia and in the vicinity of Kitungulu, Urungu.

Variation. Males with 8 preanal pores; upper labials 8; lower labials 6; 4 pairs of lamellae under the longest digit.

This lizard agrees with Hewitt's description of the three cotypes in its more pointed snout, nostril and first labial arrangement and other characters. I fail to observe the faint indications of caudal segmentation of which he speaks.

Measurements. Total length 65 (30+35) mm.

Enemies. It was presumably this species which was recovered from the stomach of a snake (*Amplorhinus nototaenia*) at Kitungulu.

Habitat. The Ikombo gecko, which made its escape, was under a log in dry maiombo orchard-bush.

Lygodactylus grotei Sternfeld

Lygodactylus grotei Sternfeld, 1911, Sitzber. Ges. Naturf. Freunde Berlin, p. 245: Mikindani and Makonde Highlands, Tanganyika Territory.

3 and eggs (M. C. Z. 30492–5) Bagamoyo. 11. xi. 29.
♀ (M. C. Z. 30496) Morogoro, Ukami. 20. xi. 29.
♀ (M. C. Z. 30497) Shinyanga, Usukuma. 4. vi. 30.

Affinities. While reëxamining part of the type series of *L. capensis mossambica* Loveridge I fail to find scale characters which will distinguish it from *grotei*. *L. c. mossambica* appears to be an intermediate between *capensis* and *grotei* having the coloring of the former and the subcaudal arrangement of transversely enlarged scales which characterises the latter. I hesitate to unite them for when I collected the type series of fifty *mossambica* I had come fresh from collecting more than a score of *grotei* and the Mozambique specimens struck me as

being different. Some fresh material from Lumbo should settle the point.

Variation. Upper labials 7–9; lower labials 5–8; 4 pairs of lamellae under the longest digit; preanal pores in male 5.

Measurements. Single male 59 (27+32) mm., largest female 62 (33 +29) mm.

Breeding. Two eggs measuring 6 x 5 mm. were found under palm fronds at Bagamoyo on 11. xi. 29. Another pair of eggs were found in a dried leaf, that is to say one egg was securely held by the leaf while the other, adhering to it, projected into space at a height of five feet from the ground. On the same day newly hatched young were seen on bananas.

Habitat. Though the Bagamoyo series were collected on bananas, others were seen on palms to the west of the town; the Morogoro gecko was also taken off a banana plant, but at Bangwe, north of Ujiji, these geckos were seen running over rocks almost at the water's edge. The species has twice been recorded from Lake Tanganyika.

LYGODACTYLUS PICTURATUS PICTURATUS (Peters)

Plate 1, fig. 1

Hemidactylus picturatus Peters. 1870, Monatsb. Akad. Wiss. Berlin, p. 115: Zanzibar.

Lygodactylus picturatus Boulenger, 1885, Cat. Lizards Brit. Mus., **1**, p. 161: Magiba, Pangani, Tanganyika Territory.

Lygodactylus manni Loveridge, 1928, Proc. U. S. Nat. Mus. **72**, Art. 24, pp. 1–2, pl. i: Saranda, Ugogo, Tanganyika Territory.

Lygodactylus picturatus picturatus Loveridge, 1929, U. S. Nat. Mus. Bull. 151, p. 46: Localities in Kenya Colony; Victoria Falls.

3 & eggs (M. C. Z. 30498–501) Mainland opp. Mombasa. 29. x. 29.
2 (M. C. Z. 30502–3) Changamwe, Kenya Colony. 31. x. 29.
6 (M. C. Z. 30504–9) Saranda, Ugogo. 28. xi. 29.
1 (M. C. Z. 30510) Bagamoyo. 11. xi. 29.
50 (M. C. Z. 30511–23) Dar es Salaam. 5. xi. 29.

Native name. Garomwe was the name applied to the male by some native children at Changamwe; when shown a female they said that it was *kibibi*, literally "little wife" in Kiswahili.

Affinities. L. manni was based on a single specimen from Saranda which had a peculiarly marked throat and differed somewhat in proportions of the head. Special search was made at Saranda on the present occasion and six topotypes secured, all in the vicinity of the Indian shops by the station; no trace of the gecko could be found in

the surrounding bush where *L. grotei* occurs. It seems highly probable that *L. manni* is an artificial importation.

The rich black and yellow coloring of the underparts quite surpassed that of coastal males but of the series only two had the gular markings of typical *manni*. Measurements of a long series of males from Dar es Salaam also reveal that Saranda specimens are within the range of variation. Under the circumstances I consider *manni* a strict synonym of *picturatus typica*.

In an attempt to define physical characters of two well-marked color varieties I utilized a watchmaker's instrument for taking very fine measurements of the length and breadth of these gecko's heads. The results are given under each variety.

Variation. Breadth of head is included in length from 1.3–1.7 times (only two with 1.7) and an average of 1.4, based on 25 geckos from 5 localities; preanal pores 6–9, average 8.0 based on 11 males.

Measurements. Largest male (No. 30518) measures 81 (41+40) mm.; largest female 72 (38+34) mm.

Breeding. Eggs taken on October 29th measured 5.5 x 6.5 mm. There were six pairs of these eggs in a hole in a palm trunk on which the adult geckos were taken, of these eggs two had hatched, one hatched on the 30th, the remainder were preserved. At Bagamoyo two eggs were found in a sunbird's empty nest.

Habitat. At Changamwe on a coconut palm and a paupau stem, young ones were seen on the fence and paling surrounding the railway station; on a tree trunk on Momboni Road, Tanga; the series from Dar es Salaam were all obtained in one day by Salimu from Acacia trees in Main Avenue. Three were taken on a *kengi* tree at Saranda, the others on acacia.

Lygodactylus picturatus var. on Mombasa Id.

Plate 1, fig. 2

Lygodactylus picturatus (part) Loveridge, 1920, Proc. Zoöl. Soc. London, p. 139: Frere Town; Mombasa; and Jilore, Kenya Colony; Loveridge, 1923, Proc. Zoöl. Soc. London, p. 941: Frere Town and Kilindini, Kenya Colony.

10 (M. C. Z. 30586–93) Kilindini, Mombasa Id. 28. x. 29.

Distribution. A female was seen at Tanga. So far as is at present known, therefore, this color variety occurs along the coast from Jilore to Tanga; at several places in the same locality as typical yellow-headed *picturatus* though never on the same trees so far as my experience goes.

Affinities. A form intermediate between *L. p. picturatus* and *L. p. gutturalis*, lacking the yellow head of the former and the gular chevrons of the latter though these are occasionally faintly indicated in females.

Variation. Breadth of head is included in length from 1.3–1.5 times (only one with 1.5) and an average of 1.37 times, based on 18 geckos from 2 localities; preanal pores 8–10, average 9.1, based on 12 males.

Measurements. Largest male (No. 30587) measures 81 (39+42) mm., largest female (No. 18537 Frere Town) measures 67 (37+30) mm.

Habitat. These geckos are now quite common on the trees forming the avenue to Kilindini station. A few hours before leaving East Africa I went ashore and unaided captured a dozen alive and uninjured. Unfortunately someone on board, probably a child, left the top of the vivarium open so that eight escaped; the remainder did not survive the voyage.

Lygodactylus picturatus var. on Ukerewe Id.

58 & eggs (M. C. Z. 30536–60) Ukerewe Id., Lake Victoria. 10–12. vi. 30.

Native name. Kihangalla (Kikerewe).

Affinities. Another form intermediate between *L. p. picturatus* and *L. p. gutturalis* but nearer to the latter than is the Mombasa form for there are definite tendencies for the black of the throat in males to form chevrons. From the Mombasa form it differs not only in the head markings but in its larger size.

Variation. Breadth of head is included in the length from 1.1–1.2 times and an average of 1.7 times, based on 25 geckos from the above series; preanal pores 7–9 (except for an aberration in one of 4), average 7, based on 15 males.

Coloration. Noted in life. ♂. Above, grey mottled with black and having a row of light colored ocelli (sometimes black-edged) along either side of the vertebral line; on the side of head and neck are about three rows of interrupted, but very conspicuous, black stripes. Below, upper and lower labials china-white marked with jet-black principally along the buccal borders; throat deep velvety-black (in some specimens, particularly in young males, there is a tendency for the black to be arranged in $\wedge$- formations); lower side of neck a rich orange, though Chinese-white in some fully adult males, extending almost to the fore arms, on either side of the neck some black speckling; a broad band along the length of the breast and belly, as also the under side of the limbs, is pale yellow; flanks on either side of this band, as also

on the underside of the tail, greyish white deepening to grey towards the tip of the tail.

♀. Above, rather more brownish-grey than the male though mottled and ocellated as in that sex. Below, greyish-white except on the breast and the pelvic area including the under side of the hind limbs which are a very pale yellow.

Young. In these the under side of the tail is frequently salmon-pink.

Measurements. Largest male (No. 30542) measures 90 (42+48) mm., largest female (No. 30544) measures 74 (37+37) mm.

Breeding. Four clutches of eggs, of which one pair is separated, were obtained on June 12th and measured 6 x 7 mm.

Enemies. Two were recovered from the stomach of a Spotted Wood Snake (*Philothamnus s. semivariegatus*).

Habitat. Some were taken on mango trees but they were more plentiful on the trunks of the imported Javan silk-cotton trees while a few were actually taken on buildings, a most unexpected place for members of this arboriphile genus.

Lygodactylus picturatus gutturalis (Bocage)

Hemidactylus gutturalis Bocage, 1873, Jorn. Sci. Lisboa, p. 211: Bissao, Portuguese Guinea.

Lygodactylus picturatus gutturalis Schmidt, 1919, Bull. Amer. Mus. Nat. Hist., **39**, p. 462: Garamba, Belgian Congo.

54 (M. C. Z. 30561–85) Ujiji, Lake Tanganyika. 28. v. 30.

Distribution. This is the first record of the occurrence of this race in Tanganyika Territory though to be expected for it had been reported from the Kivu Region by Sternfeld.

Affinities. A well-marked color variant of *L. picturatus* characterized by clearly defined chevron-shaped markings on the throat.

Variation. Breadth of head included in the length from 1.1–1.2 times (only 3 with 1.2) and an average of 1.1 times, based on 25 geckos; preanal pores 7–8, average 7.5, based on 16 males.

The whole series have been examined for broken tails and the majority found to have them intact, all such, except on the very tip, have a row of single transversely enlarged subcaudals though here and there one of these scales may be divided, such abnormalities, however, are unusual and do not form more than five per cent of the total scales on any one tail; on the other hand in regenerate tails the majority of transversely enlarged scales are only about half the width of similar scales on the uninjured basal portion of the same tail and they exhibit

a fairly high proportion of divided or small scales interspersed among the transversely enlarged ones.

Coloration. Every gecko in the series has three dark chevron-shaped gular markings, sometimes there is a spot between the arms of the posterior, i.e. smallest, chevron, or in a very few the whole area between the arms may be filled in so as to form a black triangular patch.

Measurements. Largest male (No. 30561) measures 84 (42+42) mm., largest female (No. 30577) measures 72 (37+35) mm.

Breeding. Some of the females hold large eggs but none was ready for laying.

Lygodactylus angularis Günther

Lygodactylus angularis Günther, 1893 (1892), Proc. Zoöl. Soc. London, p. 555, pl. xxxiii, figs. 1–3: Shiré highlands, Nyasaland.

1 (M. C. Z. 30468) Tandala, Ukinga Mtns. 11. ii. 30.
22 (M. C. Z. 30469–85) Madehani, Ukinga Mtns. 14–19. ii. 30.
1 (M. C. Z. 30486) Nkuka Forest, Rungwe Mtn. 28. iii. 30.

Distribution. This species, hitherto only known from Nyasaland, must now be added to the fauna of Tanganyika Territory.

Native names. *Linyarupanga* (Kihehe); *kambiri* (Kikinga); *komakipiki* (Kinyakusa; the Banyakusa consider it the young of *Agama atricollis*).

Variation. Upper labials 5–8, average of forty-eight counts almost 7; lower labials 5–7, average 6; preanal pores of males 5–8, average 6. The transversely enlarged subcaudals distinguish this fine gecko from *L. fischeri*, the only other rain-forest member of the genus which approaches it in size.

Coloration. The gular pattern of this species at once distinguishes it from all other East African members of the genus, roughly it might be said that the chevrons of *L. p. gutturalis* are inverted with their apices pointing towards the body, they are well shown in Günther's plate.

The Tandala male, in life, had the six gular lines on a lemon-yellow background, with the exception of the forearms the rest of the undersurface was rose-pink, brighter in the anal region. No other East African *Lygodactylus* has a pink ventral surface.

Females from Madehani differed entirely from the males in being wholly lemon-yellow below without any rose-pink. The gular lines show considerable variation in detail though remaining characteristic.

Measurements. The largest of nine males measures 84 (42+42) mm.; the largest of fifteen females 81 (46+35) mm.

Breeding. Eggs in various stages of development were present in all the females taken at Madehani, 14–19. ii. 30, the largest ova measured 8 mm. in diameter and were presumably about ready for laying; others held eggs of 7 and 6 mm. diameter on the 14th. Two eggs only are developed at a time.

Diet. Stomachs of ten geckos were examined with the following results:— (1) Many beetles, including a Curculionid and Lampyrid, (2) beetles, (3) beetle, ant, (4) beetle larvae, spider, (5) beetle, two caterpillars, (6) beetle, two caterpillars of which the larger measured 35 mm.! (7) hairy caterpillar, (8) big black ant, (9) ants, bug, (10) bug, spider. In addition two lizards held remnants of eggshell which I have little hesitation in saying were from Lygodactyli eggs, they were in the stomachs, *not* oviducts, and I feel certain that they were not snail shells.

Parasites. Acarine parasites are present near the anus.

Habitat. The first specimen was on the trunk of an eucalyptus tree immediately behind the kitchen building of the ruined German mission house at the end of the long avenue.

Being a species unknown to me I was thereafter continually on the search for more but found none until, shortly after our arrival at Madehani, I shot two on tree trunks flanking the road where it passes through big forest. These specimens were shown to all local natives and one particularly bright lad responded by bringing in sixteen; six of these had discarded their tails but he had the good sense to bring in the tails as well. It should not be inferred from this that the species is particularly abundant at Madehani for though I was constantly on the lookout for this gecko I rarely saw more than one per day during the three weeks of our stay. One I shot on an iron telegraph pole; another, which I caught on a tree-trunk, was engaged in casting its skin.

PACHYDACTYLUS BOULENGERI Tornier

Pachydactylus boulengeri Tornier, 1897, Kriechthiere Deutsch-Ost-Afrikas, p. 26, pl. ii, figs. 1–2: Tabora and Kakoma, Tanganyika Territory; Loveridge, 1923, Proc. Zoöl. Soc. London, p. 941: Sagayo, Tanganyika Territory.

Elasmodactylus triedrus Boulenger, 1913, Revue Zoöl. Afr., **3**, p. 104, text fig: Kikondja, Katanga, Belgian Congo; Loveridge, 1920, Proc. Zoöl. Soc. London, p. 140: Morogoro and Kongwa, Tanganyika Territory; 1923, Proc. Zoöl. Soc. London, p. 942: Suna, Tanganyika Territory; 1928, Proc. U. S. Nat. Mus., **73**, Art. 17, p. 63: Saranda, Tanganyika Territory.

1 (M. C. Z. 30594) Tanga. 2. xi. 29.
1 (M. C. Z. 30595) Handa, Usandawi. 10. xii. 29.
1 (M. C. Z. 30596) Mangasini, Usandawi. 11. xii. 29.
5 (M. C. Z. 30597–601) Saranda, Ugogo. 28. xi. 29.
5 (M. C. Z. 30602–5) Nyamkolo, Lake Tanganyika. 9. v. 30.
2 (M. C. Z. 30606–7) Kasanga, Lake Tanganyika. 16. v. 30.
3 (M. C. Z. 30608–10) Shinyanga, Usukuma. 3. vi. 30.

In addition the following material from Tanganyika Territory in the Museum of Comparative Zoölogy has been employed for collecting the undermentioned data.

1 (M. C. Z. 18265) Sagayo, Usukuma. 13. xi. 22.
1 (M. C. Z. 18270) Kongwa, Ugogo. 21. iv. 17.
2 (M. C. Z. 18271–2) Suna, Unyaturu. 8. x. 21.
1 (M. C. Z. 22977) Mbala, Usagara. 26. ii. 23.
1 (M. C. Z. 23045) Saranda, Ugogo. 19. vi. 26.

Relations. The specimens from Morogoro and Kongwa referred to in the above citation, were determined for me as *E. triedrus* by Boulenger himself. The holotype being at the Congo Museum, Tervueren, we depended on the description and text figures.

During the present expedition I obtained material from all round the type locality of *P. boulengeri* and southwards to Nyamkolo where there is an admixture of Katanga fauna (e.g. *Chilorhinophis gerardi*, *Mabuya perrotetii*, etc.) and one might reasonably expect to find *E. triedrus*. Nyamkolo geckos, however, are indistinguishable from those of Central Tanganyika.

P. boulengeri lacks, or at least I fail to find, a minute, concealed, retractile claw on the digits which is one of the alleged generic characters of *Elasmodactylus*. Though *triedrus* was referred to that genus no definite claw appears in the enlarged drawing of the foot, nor is specific mention of a claw made in the very detailed description. As the descriptions and figures of the two species appear to be in entire agreement I have little doubt but that they represent a single species.

Subsequently to writing the above the Kongwa gecko was sent to Dr. Gaston de Witte at the Congo Museum. He replies: "I have very carefully compared your specimen with the type of *Elasmodactylus triedrus* Boulenger. You are perfectly right. It is impossible to discover retractile claws, but there are small sheaths which perhaps made it appear as if retractile claws existed. This character seems to have little importance and one should perhaps unite *Elasmodactylus* and *Pachydactylus*. Your identification of it with *Pachydactylus boulengeri* is correct."

Variation. Upper labials 8–11; lower labials 6–9; nostril pierced between the rostral, 1st labial and 3 or 4 small scales, in 12% of the series, however, the 1st labial is excluded from bordering the nostril; males with 7–10 preanal pores, average of ten males is 7.7. The species is very distinct from *P. bibronii* of which there are specimens from Igulwe and Dodoma, Ugogo in the Museum of Comparative Zoölogy.

Measurements. Largest of ten males (No. 23045) measures 167 (79+88) mm.; largest of fourteen females (No. 30608) measures 133 (63+70) mm. The Tanga gecko is very young being only 47 (25+22) mm.

Habitat. The Tanga specimen was taken among rejected *mcuti* thatching beside a hut; the Handa gecko beneath the bark of a dead, but still standing, tree beside the trail from Masiliwa to Handa; it already lacked a tail when first seen. Apart from the Mangasini lizard which was brought in by a native, all the rest were found on the whitewashed walls of huts or houses. At night they emerge from the thatch or roof where they spend the day in complete concealment. So shy of a flashlight were these geckos at Saranda and Nyamkolo that they made for the eaves as soon as the light fell upon them, this timidity made it necessary to shoot them with a fine charge of dust shot which did not damage them in the least.

Diet. Beetles were recovered from the stomach of a Saranda gecko.

Phelsuma laticauda (Boettger)

Pachydactylus laticauda Boettger, 1880, Zoöl. Anz., **3**, p. 280: Nossi-Bé, Madagascar.

Phelsuma laticauda Loveridge, 1920, Proc. Zoöl. Soc. London, p. 139: Dar es Salaam; 1925, Proc. Zoöl. Soc. London, p. 74: Zanzibar; Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl. **50**, p. 146: Dar es Salaam and Bagamoyo, Tanganyika Territory.

Breeding. Broken egg-shells of the Palm Gecko were seen at a height of six feet from the ground in crevices of the trunks of a coconut palm. As these are the first I have ever seen I assume that the species usually lays in the crowns of the palms where it lives. Though no specimens of this gecko were secured during our brief stay at Bagamoyo one of my collectors obtained a good series on a previous visit.

Enemies. Remains of a Palm Gecko were found in the stomach of a Tiger Snake (*Tarbophis semiannulatus*).

AGAMIDAE

Agama hispida armata Peters

Agama armata Peters, 1854, Monatsb. Akad. Wiss. Berlin, p. 616: Rios de Sena, Tete, Mozambique.

Agama hispida var. *distanti* Loveridge (*nec.* Boulenger), 1923, Proc. Zoöl. Soc. London, p. 942: Tanganyika Territory records.

3 (M. C. Z. 30611–2) Gulwe, Ugogo. 21. xi. 29.
12 (M. C. Z. 30613–6) Unyanganyi, Turu. 3. xii. 29.
2 (M. C. Z. 30617–8) Mangasini, Usandawi. 14. xii. 29.
1 (M. C. Z. 30619) Ikikuyu, Ugogo. 21. xii. 29.
1 (M. C. Z. 30746) Near Ikombo, N. Rhodesia. 6. v. 30.

Correction. On my way out to East Africa in 1914 I collected some agama lizards at Delagoa Bay, Mozambique which were submitted to Dr. G. A. Boulenger and referred by him to *distanti*, a species which he had described from Pretoria and Rustenberg, Transvaal. In 1923, and in several subsequent papers, I referred all Tanganyika examples to *hispida distanti* using the Delagoa Bay specimens for reference. Recent examination of topotypes of *distanti*, however, has revealed that the Delagoa Bay agamas (and consequently all my Tanganyika material) were not of that race but should be referred to *Agama hispida armata*.

Variation. The ventrals are faintly keeled except in one male (No. 30613) where they appear to be smooth; the middle (3rd) toe is longer than the 4th except in two specimens (No. 30614) where the 4th is slightly longer. Whether the ear-opening is larger than the eye-opening is an impossible character to decide upon where both are so much of a size, generally they are substantially equal, but if the vertical—as opposed to the horizontal—diameter of the ear-opening be taken then it is larger than the eye-opening. Preanal pores in the males 10–13.

Measurements. Largest male 228 (90+138) mm.; largest female 196 (81+115) mm. Both are from Gulwe and both are exceeded by 5 mm. in body length by Unyanganyi agamas with injured tails. Smallest agama (No. 30746) measures 75 (37+38) mm.

Breeding. All the Unyanganyi females are heavy with eggs ready for deposition; in three lizards examined the eggs numbered 10, 12 and 13 respectively, while they measured 15 x 10 mm., 13 x 9 mm., and 12 x 8 mm.

Parasites. Immature nematodes (*Physaloptera* sp.) were preserved from an Unyanganyi agama.

Habitat. The Gulwe specimens were taken on stumps in the desert two hundred yards south of the railway station; those from Unyanganyi were captured on baobab as well as smaller trees.

Agama agama lionotus Boulenger

Agama lionotus Boulenger, 1896, Proc. Zoöl. Soc. London, p. 214, pl. viii: southeast of Lake Rudolph, Kenya Colony.

Agama agama lionotus Loveridge, 1929, U. S. Nat. Mus. Bull. **151**, pp. 48 and 53: Kenya Colony and Tanganyika Territory localities.

4 (M. C. Z. 30620–3) Kilindini, Mombasa Id., K. C. 28. x. 29.

Variation. Midbody scales rows in males 70, in females 69–73; preanal pores in males 11–14.

Coloration. Male. Above, crown and sides of head gamboge or mustard yellow which extends as a gradually narrowing streak along the vertebral line to midbody, the rest of the vertebral streak to the tail is silvery; sides of body very dark navy blue upon which two parallel rows of large black blotches may be discerned; fore limbs metallic light blue; hind limbs metallic greenish-blue ringed with lighter as every third scale-row is almost white. Below, throat, including the gular skin, brick-red; shoulders metallic ultramarine; on the sides of the neck a small patch of black separates the yellow from the blue; body greenish-blue except for a narrow line from about midbody, this widens till it almost excludes the blue from the preanal region and from the undersides of the hind limbs and the lower surface of the tail.

Measurements. Larger male measures 262 (112+150) mm.; larger female 231 (85+146) mm.

Breeding. Both females were bloated with eggs which took up all available space in the body cavity extending forward to the chest. These eggs, which numbered 6 and 7 respectively, varied greatly in size according to the position into which they had been squeezed, three measured as follows:—21 x 10 mm., 20 x 11 mm. and 19 x 12 mm.

Diet. Ants appeared to form the principal stomach contents but there were remains of beetles and a single millipede.

Parasites. Nematodes were present.

Habitat. On the outward voyage these lizards were abundant on Kilindini wharf where they basked upon the piles of girders and sought refuge from pursuit beneath them; they also occurred along the fence of corrugated iron sheets which encloses the wharf and which was

flanked with a rank growth of weeds and piles of rock. On the return voyage it was observed that the girders had been removed and the lizards were apparently not so plentiful. It is doubtful, however, whether the clearing up of the area will greatly affect them as they have taken to living on the walls of the warehouses opposite the station and retire beneath the roofs if molested.

Agama agama mwanzae Loveridge

Plate 2, fig. 4

Agama lionotus var. *mwanzae* Loveridge, 1923, Proc. Zoöl. Soc. London, p. 945: Shanwa, Mwanza, Tanganyika Territory.

19 (M. C. Z. 30624–35) Shinyanga, Usukuma. 3. vi. 30.
37 (M. C. Z. 30636–60) Mwanza, Usukuma. 6. vi. 30.
26 and eggs (M. C. Z. 30661–85) Ukerewe Id., Lake Victoria. vi. 30.

Distribution. Hitherto this race has not been recorded from outside the Usukuma country where it occurs at Mwadira and Sagayo in addition to the four localities given above.

Native names. Kuli (Kisukuma); *butungu* (Kikerewe).

Variation. Midbody scale-rows in fifteen males 72–84, in fifteen females also 72–84; preanal pores in fifty males 8–12, average 10, two males have supernumary rows of 9 and 2 pores respectively which were omitted from the count.

Coloration. An exceptionally handsome male had two dark blue patches on the posterior portion of its rich magenta throat, this constitutes a quite abnormal variation.

Measurements. The largest male (Shinyanga) measures 364 (129+235) mm.; largest female (Mwanza) is 275 (115+160) mm.

Breeding. At noon on June 11th, as I was walking along a sandy path on Ukerewe Island, I observed the head of a female agama protruding from a horizontally oval hole in the path; even as my eye fell upon her she darted out and as she did so I observed an egg roll back into the hole. A closer examination of the hole showed that its entrance was about three inches wide by an inch in height, for the first three or four inches the burrow sloped steeply downwards so that its terminus was two and a half inches below the surface. Besides the egg which I had seen roll back, and which was lying on some loose sand, four other eggs were found packed in loose sand beneath an undercut ledge of soil which had not been disturbed. The eggs were white and measured 21 x 9 mm., the texture of their envelopes being of the same tough, parchment-like structure common to snakes' eggs.

Parasites. These specimens showed the same heavy infestation of

nematodes (*Strongyluris brevicaudata* and *S. ornata*). that I have noted elsewhere.

Enemies. Several eggs of this agama were found in the stomach of a Nilotic Monitor (*Varanus niloticus*) which I shot as it was basking on a promontory on which *A. a. mwanzae* were more abundant than anywhere else on those parts of the island which I visited.

Habitat. At Shinyanga these lizards were very plentiful on the group of rocks southwest of the railway station. On Ukerewe Island it seemed as if the agamas were less plentiful inland where the rocks did not provide them with so many fissures as along the shore.

Agama agama turuensis Loveridge

Plate 2, fig. 1

Agama agama turuensis Loveridge, 1932, Bull. Mus. Comp. Zoöl., **72**, p. 376: Unyanganyi, east of Singida, Tanganyika Territory.

36 (M. C. Z. 30686–30710) Unyanganyi, Turu. 3–4. xii. 29.
24 (M. C. Z. 30711–30735) Mangasini, Usandawi. 12. xii. 29.

Distribution. Both geographically and in its gular markings this form is intermediate between the northern *A. a. lionotus* and more southerly *A. a. dodomae*. The former has a plain red throat and the latter a red centre surrounded by a broad blue band of which the marking in *turuensis* is obviously the beginning for three of the sixty specimens listed above show faint traces of this marking which is strongly developed in *dodomae* though in blue instead of black.

Affinities. Since describing this form I have had the opportunity of examining one of the male cotypes of *Agama elgonis* Lönnberg which is undoubtedly so nearly related to *turuensis* that the latter may have to be ultimately placed in the synonymy of *A. a. elgonis*. On the basis of the available data (7 topotypes of *elgonis* and 60 of *turuensis*) they may be distinguished as follows:

Midbody scale-rows 80–90; preanal pores in males 14 *A. a. elgonis*
Midbody scale-rows 72–82; preanal pores in males 9–14, average for thirty-four males 11.3 .... *A. a. turuensis*

It is important to note that the gular markings are identical though *elgonis* comes from an altitude of 8,000 feet and *turuensis* only *circa* 4,500 feet.

Diet. Ants and termites are present in the stomachs.

Parasites. Nematode worms (*Oochoristica theileri*) in stomachs.

Habitat. Usually found on rocks but a few were living in holes of the baobab trees.

Agama agama dodomae Loveridge

Plate 2, fig. 2

Agama lionotus var. *dodomae* Loveridge, 1923, Proc. Zoöl. Soc. London, p. 944: Dodoma, Ugogo, Tanganyika Territory.

10 (M. C. Z. 30736–40) Dodoma, Ugogo. 23. xii. 29.

Distribution. Also seen at Kilimatinde and Saranda. The above series of ten males were shot between Dodoma and Kikuyu, the latter being less than two miles from Dodoma. The race seems to occur south of Dodoma nearly to the Ruaha River as many were seen, though none collected, on the motor run from Dodoma to Iringa.

Variation. Preanal pores 10–12, average 11.4, which agrees with that of the type series of 35 specimens.

Parasites. Nematodes (*Strongyluris gigas* and *Strongyluris ? ornata*) were recovered from the stomachs of these agamas.

Agama agama ufipae Loveridge

Plate 2, fig. 3

Agama agama ufipae Loveridge, 1932, Bull. Mus. Comp. Zoöl., **72**, p. 377: near Kipili, Ufipa, Tanganyika Territory.

5 (M. C. Z. 30741–5) Kipili, Ufipa. 19. v. 30.

Coloration in life.—♀ paratype. Above, crown of head nearly black with sharply defined white spots; back pale buff, heavily vermiculated with black-edged, vermilion lines, black-edged white spots and sepia-colored blotches; fore limbs grey vermiculated with brown; hind limbs and tail sandy-buff vermiculated with sepia brown and black. Below pure white, except on the throat which is dusky in the centre and almost cream on the sides.

Parasites. Nematodes (*Physaloptera sp.*) were present in the stomachs.

Agama atricollis Smith

Agama atricollis A. Smith, 1849, Illus. Zoöl. S. Africa, **3**, Appendix, p. 14: Natal, South Africa.

1 (M. C. Z. 30747) Matema, near Mwaya. 28. ii. 30.
1 (M. C. Z. 30748) Mwaya, Lake Nyasa. 1. iii. 30.
3 (M. C. Z. 30749–51) Tukuyu, Rungwe. 13. iii. 30.
1 (M. C. Z. 30752) Ilolo, Rungwe. 28. iii. 30.
9 (M. C. Z. 30753–4) Entebbe, Uganda. 27. vi. 30.
3 (M. C. Z. 30755–6) Kampala, Uganda. vi. 30.
2 (M. C. Z. 30757–8) Jinja. Uganda. 30. vi. .30.
13 (M. C. Z. 30759–60) Mabira Forest, Uganda. 1. vii. 30.

Distribution. Also seen on trees in King Street, Tanga and near the Sise River on the Tukuyu-Abercorn Road, Northern Rhodesia.

Native names. *Kanakipiki* and *komakipiki* (Kinyakusa, but these names are applied to the geckos *Lygodactylus* and *Hemidactylus* which the Banyakusa believe to be the young of the agamas).

Variation. The nasal opening is actually below the sharp edge of the canthus; the ventrals in all these specimens show some keeling, in some scarcely distinguishable, in others very strong but uncorrelated with geographical distribution; males possess two and even three rows of preanal pores, in cases where three occur the anterior is ill-defined, the posterior row has from 10–12 pores, the second 8–13.

Measurements. The largest male (Mwaya) measures 345 (151+194) mm. the largest female (Entebbe) 285 (110+175) mm.

Breeding. Two of the Mabira Forest agamas were examined and found to hold 22 and 21 eggs respectively, these measured 14 x 9 mm. and were apparently ready for laying.

Diet. Beetles in the Ilolo specimen. One captive agama was seen to swallow a yellow migratory locust which came on board ship when in the Red Sea.

Parasites. Nematodes (*Strongyluris ornata*) were preserved from Matema and Entebbe specimens.

ZONURIDAE

Zonurus Ukingensis Loveridge

Plate 3, fig. 2

Zonurus ukingensis Loveridge, 1932, Bull. Mus. Comp. Zoöl., **72**, p. 378: Tandala, Ukinga Mtns., southwestern Tanganyika Territory.

Type (M. C. Z. 30761) Tandala, Ukinga Mtns. 11. ii. 30.

Affinities. In addition to the diagnostic characters already published it might be added that it is obviously not conspecific with *tropidosternum*, the only other species occurring in Tanganyika Territory or any of those forms which have granular skin showing between the lateral scales (*vide.* Nieden, 1913, Mitt. Zoöl. Mus. Berlin, **7**, p. 71, and Loveridge, 1920, Proc. Zoöl. Soc. London, p. 143). Moreover the shape of its frontonasal is entirely different from that of *tropidosternum* and that scale is separated from the rostral in the new form, not by a narrow suture of the nasals as sometimes occurs in *tropidosternum*, but by the whole breadth of the nasals. The complete, unpublished, description of the type follows.

Description. ♂. Head not depressed, longer than broad; head shields rugose; frontonasal as broad as long, separated from the rostral

by the nasals which are broadly in contact; nostril pierced in the infero-lateral edge of a large nasal separated from the first labial by a narrow rim, prefrontals and a large preocular; prefrontals separated on the middle line by a small shield lying between the frontal and the frontonasal (apparently split off from the latter and possibly an abnormality); frontal narrow, its lateral sides almost parallel, twice as long as broad; a pair of postfrontals separating the frontal from the anterior parietals; an occipital scale in the middle of a square formed by a pair of anterior and a pair of posterior parietals; 4 supraoculars; 3 supraciliaries, the anterior very long; lower eyelid scaly and opaque; a large preocular; no loreal; 4 suboculars; 5 upper labials, the last three keeled; 5 lower labials, the last three keeled; a large mental followed by 5 pairs of chin-shields, the first pair in contact, the rest widely separated by small, but very strongly keeled, gular scales which are mucronate posteriorly.

Dorsal scales large, their prominent keels forming raised ridges along the back, 31 scales between parietal and base of tail; flank scales rounded and strongly mucronate; 28 midbody scale-rows of which 10 constitute the ventral series; ventrals obtusely keeled in 30 longitudinal rows exclusive of the row of preanals in which the middle pair are enlarged; 16 femoral pores. Tail with 13 whorls of scales, the dorsal ones with enormously developed spines.

Chamaesaura miopropus Boulenger

Chamaesaura miopropus Boulenger, 1894, Proc. Zoöl. Soc. London, p. 732: Fuambo, Nyasaland; Sternfeld, 1911, Mitt. Zoöl. Mus. Berlin, p. 385: Livingstone Mountains, Tanganyika Territory.

1 (M. C. Z. 30762) Dabaga, Uzungwe. Mtns. 1. i. 30.
1 (M. C. Z. 30763) Ipemi, Uzungwe Mtns. 8. i. 30.
1 (M. C. Z. 30764) Ihenye, Ukinga Mtns. 8. ii. 30.
1 (M. C. Z. 30765) Tandala, Ukinga Mtns. 11. ii. 30.
1 (M. C. Z. 30766) Igale Pass, Poroto Mtns. 30. iv. 30.

Distribution. The Ukinga Mountains are the northern portion of the Livingstone Range; these new records link up the two earlier ones and extend the distribution to the northeast.

Native names. *Nyoka lusagalla* (Kihehe); *nunduswa* (Kikinga).

Variation. To the original description the following may be added. Midbody scale-rows 24–26; upper labials 5–6; lower labials 4–5; femoral pores 1–2.

Measurements. The largest lizard (Ihenye) measures 455 (106+349)

mm., and the smallest (Ipemi) only 157(42+111) mm. The length from snout to vent is included in the total length from 3.6 to 5.5 times and probably has some sexual significance.

Breeding. The Igale female held a round egg measuring 7 mm. in diameter.

Diet. An examination of the stomachs of the three largest lizards revealed (1) a black field cricket, (2) black field cricket and what appeared to be a beetle larva, (3) grasshopper and caterpillar.

Habitat. Taken in long grass through which they travel with great speed and when on the move are indistinguishable from snakes.

VARANIDAE

Varanus niloticus (Linnaeus)

Lacerta nilotica Linnaeus, 1766, Syst. Nat., ed. 12, p. 369: Egypt.

1 (M. C. Z. 30769) Bagamoyo. 9. xi. 29.
4 (M. C. Z. 30770) Mwaya, Lake Nyasa. 1–8. iii. 30.
4 (M. C. Z. 30771) Kasanga, Lake Tanganyika. 16. v. 30.
1 (M. C. Z. 30772) Mwanza, Lake Victoria. 6. vi. 30.
1 (M. C. Z. 30773) Ukerewe Id., Lake Victoria. 13. vi. 30.

Distribution. The foregoing were collected only for record. Nilotic Monitors were seen at Kilipi, Ujiji and Entebbe.

Native name. *Mbulu* (Kinyakusa).

Breeding. In the oviducts of the Ukerewe specimen were 21 eggs, each measuring 43 x 30 mm.

Diet. The stomach contents were as follows:—(1) A string of what appeared to be snake's eggs, this opinion being strengthened by the presence of transverse ventral scutes, this monitor also held nineteen large slugs (*Eleutherocaulis brevis*) Bagamoyo; (2) four snails at Mwaya; (3) grasshoppers, beetles and a crab's claw at Kasanga; (4) cockroaches, cricket and a large spider at Mwanza; (5) eggs of *Agama agama mwanzae* on Ukerewe Island.

Parasites. The Bagamoyo monitor had spotted ticks (*Aponomma exornatum*) about the anus, and brown ones of the same species in the armpits and elbow joints. Short worms (*Tanqua tiara*) in the stomach and enormously long ones (*Stronglurus brevicaudata* and *S. ornata*) in the mesentery. A ♀ Filarioidea and tapeworms in a Mwaya specimen. Several lots of cestodes and nematodes (*T. tiara* and *Duthiersia fimbriata*) as well as a ♀ Oxyuroid were preserved from the Kasanga series. *Tanqua tiara* in the Ukerewe Monitor.

Enemies. The tail of a Kasanga monitor was dead and dried, the suggestion was that it had been bitten by an aquatic cobra (*Boulengerina a. stormsi*).

AMPHISBAENIDAE

Amphisbaena mpwapwaensis Loveridge

Plate 3, fig. 1

Amphisbaena mpwapwaensis Loveridge, 1932, Bull. Mus. Comp. Zoöl., **72**, p. 378: Mpwapwa, Ugogo, Tanganyika Territory.

Types. ♂ ♀ (M. C. Z. 30767–8) Mpwapwa, Ugogo. 22. xi. 29.

Habitat. These specimens were taken by digging in dry earth beneath a fallen tree close to a stream which meanders past the front of the new Veterinary Headquarters office built in 1929.

LACERTIDAE

Nucras boulengeri boulengeri Neumann

Nucras tessellata Tornier (*nec.* A. Smith), 1897, Kriechthiere Deutsch-Ost-Afrikas, p. 39: South shore Victoria Nyanza.

Nucras delalandii Tornier (*nec.* Milne-Edwards), 1900, Zoöl. Jahrb. Syst., **12**, p. 593: Kakoma, Tanganyika Territory.

Nucras boulengeri O. Neumann, 1900, Ann. Mag. Nat. Hist. (7), **5**, p. 56: Lubwa's, Usoga, Uganda.

Nucras emini Boulenger, 1907, Ann. Mag. Nat. Hist. (7), **19**, p. 488: Southern shore of Victoria Nyanza, Tanganyika Territory.

Nucras ukerewensis Bolkay, 1909, Archivum Zoöl. Budapest, **1**, p. 13, figs.: Shirati, Tanganyika Territory.

55 (M. C. Z. 30774–85) Unyanganyi, Turu. 4. xii. 29.
2 (M. C. Z. 31003–4) Masiliwa, Turu. 9. xii, 29.
1 (M. C. Z. 30786) Mangasini, Usandawi. 16. xii. 29.
1 (M. C. Z. 30787) Shinyanga, Usukuma. 3. vi. 30.

Distribution. East African records of this lizard are much involved; after an era in which attempts were made to identify them with South African members of the genus a decade followed in which specimens from the North, South and East shores of Lake Victoria received names. I have visited all three type localities presuming that "Lubwas" means Lubwa's village near Fort Lubwa, Usoga and there is nothing in the topography which would lead one to expect differentiation of the fauna.

The present range of *N. b. boulengeri*, as understood by me, is from the East bank of the Nile at its source to Eldama River in Kenya

Colony southeast to Mt. Kilimanjaro then due south to Kilosa where it meets with *N. b. kilosae*, thence due west to Kakoma and north through Tabora and Shinyanga to the South shore of Victoria Nyanza.

Affinities. The coloring of *N. b. boulengeri* is so very distinct from that of *N. tessellata* that it was a source of surprise to me how records of the latter kept recurring in the literature even after the descriptions of *boulengeri* and *emini* had appeared. A few years ago a series of specimens from the Loita Plains, Kenya Colony were received which differ from all Tanganyika examples that I have seen by possessing ocelli along the flanks and an olive ground color instead of a sandy or red-brown. I cannot help feeling that the records of *tessellata* are based on lizards of this type. There do not appear to be any scale characters on which they can be separated, an apparent average number of femoral pores may well disappear when larger series are available. Specimens from Bissel, Kenya Colony and the adjacent Longido country are somewhat intermediate though lacking ocelli. Until more material is available it seems inadvisable to recognize this race, it may be that the name *ukerewensis*, which Boulenger considered a synonym of his *emini*, might be used for this form.

Boulenger, at the time of the writing of his Monograph of the Lacertidae, had very little East African material of the genus *Nucras*. *N. boulengeri* he only knew from the description and attempted to keep it distinct from *emini* on a supposed difference in the relative head lengths. The Unyanganyi series alone shows that the number of times which the head is included in the length from snout to vent is of no taxonomic importance in differentiating East African forms. The following figures are based on an examination of 50 *boulengeri* from a dozen different Tanganyika localities, 5 of the Loita Plains variety and half-a-dozen topotypic Kilosa lizards.

N. boulengeri boulengeri	4.1–5.1	times
N. boulengeri var. (Loita)	4.1–4.9	"
N. boulengeri kilosae	4.2–4.6	"

At present I distinguish these forms by the following key:—

Dorsal scales smooth . . . . 1.

Dorsal scales keeled; body dark brown with richer and more abundant color pattern than the typical form, includes a distinct light vertebral line . . *N. b. kilosae*

1. Femoral pores average 11.5 (range 11–15); back light sandy-brown, uniform or finely speckled with black, a vertebral line usually absent, or if present, indistinct, except in the young . . . . *N. b. boulengeri*

Femoral pores average 10 (range 9–12); back olive or olive-brown, much linear spotting of black and white (the latter formed from broken white lines) on back, with ocelli (white, ringed with black) on the flanks, more definite in some than in others .... *N. b.* var.

Variation. The following data is based on 50 specimens from a dozen localities in Tanganyika, only 12 of the Unyanganyi series have been utilized. Dorso-lateral scale-rows across midbody 35–49, 40–49 except for three lizards from the vicinity of Tabora and Suna; transverse rows of ventrals 28–34; longitudinal rows of ventrals 8; lamellar scales under 4th toe 17–24; femoral pores 9–15.

Coloration. In addition to their more vivid dorsal coloring the young have bright red tails.

Measurements. Largest intact specimen (Gwao's village) 190 (60+130) mm., but four with reproduced tails surpass this in length from snout to vent being 67, 66, 66 and 61 mm. respectively. The smallest (Mukwese) lizard measures 98 (35+63) mm.

Diet. The stomach contents of a dozen Unyanganyi lizards were:— (1) Cricket, (2) cricket, (3) cricket, (4) beetle, (5) grasshopper, termites, spiders, (6) termites, (7) termites, millipede annuli, stone, (8) termites, ants, (9) warrior termite, ant, (10) fly, spider, stone, (11) three spiders, (12) nil.

At Masiliwa, following a heavy shower between 4 and 5 p.m. on December 9th, termites started flying in great numbers. After sunset, when already dusk, I picked up two of these lizards so gorged with termites that they scarcely tried to escape. One indeed ran slowly to its hole and inserted its head but could not get its body in; the hole being vertical, the sight was rather amusing, the lizard alternately wriggling hard, then resting quiescent, after which I picked it up!

Enemies. On a path near Maji Malulu I disturbed a sandsnake (*Psammophis biseriatus*) swallowing one of these lizards whose head was already in its mouth. Two others were recovered from the stomachs of *Psammophis subtaeniatus* at Unyanganyi.

Latastia johnstonii Boulenger

Latastia johnstonii Boulenger, 1907, Ann. Mag. Nat. Hist. (7), **19**, p. 392: Nyika Plateau, Nyasaland; Boulenger, 1921, Monogr. Lacert., **2**, p. 16: Localities in Mozambique, Nyasaland, Southern Rhodesia and Tanganyika Territory.

Latastia siebenrocki Nieden (*nec.* Tornier?), 1913, Mitt. Zoöl. Mus. Berlin, **7**, p. 77: Tabora, Tanganyika Territory: Eldama River, Kenya Colony.

4 (M. C. Z. 30788–91) Saranda, Ugogo. 28. xi. 29.
12 (M. C. Z. 30793–800) Unyanganyi, Turu. 3. xii. 29.
2 (M. C. Z. 30801–2) Mangasini, Usandawi. 16. xii. 29.

Distribution in Tanganyika Territory. I have previously recorded this lizard from Morogoro; Tindiga near Kilosa; Manyoni; Tabora; Nyambita; Sagayo and Bukoba.

In 1905 Tornier described as *Eremias siebenrockii* a lizard from Porto Novo, Dahomey, West Africa which in 1913 Nieden showed was a *Latastia* and with which he identified a lizard from Tabora and four from Eldama River. The East African records are undoubtedly referable to *johnstonii* whose occurrence in German East Africa was unknown at the time Nieden wrote. *L. johnstonii* is abundant at Tabora and as we know that it occurs alongside *Nucras b. boulengeri* in many places in Tanganyika there is no reason to suppose that there is any question of the Eldama records, for *N. b. boulengeri* has already been recorded from that locality.

Affinities. Boulenger separates the two species as follows:—

No gular fold; edge of collar serrated; 13–16 femoral pores on each side . . . . *johnstonii*

A gular fold; edge of collar even; 10–14 femoral pores on each side . . . . *siebenrocki*

actually the type had 11, the Eldama lizards 10–13 and the Tabora lizard 14.

The character of the gular fold is difficult to decide, undoubtedly East African lizards have no fold though it is indicated; while the edge of the collar is serrated normally, in the Mangasini lizards it might be said to be even; the Eldama specimens negative the alleged difference in the number of femoral pores. Nieden states very definitely that there is no difference in markings.

Should *siebenrockii* prove to be synonymous with *johnstonii* it would have to take precedence. One wonders if the type of the former really did come from Porto Novo but until that is settled it would be dangerous to assume identity between two species in such widely separated localities.

Variation. Basing the count on 25 lizards from ten Tanganyika localities as listed above. Midbody scale-rows 39–55; femoral pores 12–17, with an average of 14, if the Eldama specimens are included, then 10–17.

Measurements. The largest (No. 30802) measures 182 (62+120) mm., though several have tails longer by 20 mm.

Diet. Stomach contents of eight Unyanganyi lizards were composed,

in every instance, of termites, some were of a very large species; in addition to the termites one lizard appeared to have eaten an antlion larva. On being caught a Mangasini lizard disgorged two antlion larvae.

Habitat. This species favors the sandy thorn-bush steppe which, though at a high altitude, is often very hot during the day. These lizards were fairly plentiful at Saranda and Unyanganyi where they were collected in desiccated *mbugwe* and sandy gardens. At Mangasini it was interesting to note its occurrence alongside its big relative, *L. longicaudata revoili*, but while *revoili* was plentiful, *johnstonii* was scarce. It was surprising that no examples were collected between Central Tanganyika and the type locality—Nyasaland.

Latastia longicaudata revoili (Vaillant)

Eremias revoili Vaillant, 1882, Miss. Révoil Pays Çomal., Rept., p. 20, pl. iii, fig. 2: Somaliland.

Latastia longicaudata var. *revoili* Boulenger, 1921, Monog. Lacertid., **2**, p. 30.

1 (M. C. Z. 30792) Kilimatinde, Ugogo. 29. xi. 29.
16 (M. C. Z. 30793–30810) Mangasini, Usandawi. 12–16. xi. 29.

Distribution. Other Tanganyika material used in this study is from Mtali's village, Mkalama; Bahi and Dodoma, Ugogo.

Variation. Midbody dorso-lateral scale-rows 54–70; transverse ventral rows 28–32; femoral pores 6–11 with an average of 8.7 pores for 52 counts.

Measurements. The largest (No. 30807) measures 317 (100+217) mm.; the smallest 102 (32+70) mm. was taken at Dodoma on May 14, 1926.

Diet. At Kilimatinde I watched one pick up a bleached fragment of *Achatina* shell twice, dropping it each time.

Parasites. Nematodes (*Strongyluris brevicaudata*) were present in a Mangasini lizard.

Ichnotropis bivittata Bocage

Ichnotropis bivittata Bocage, 1866, Jorn. Sci. Lisboa, **1**, p. 43: Duque de Bragança, Angola: Boulenger, 1921, Monogr. Lacertid., **2**, p. 183: French Congo; Belgian Congo and Angola.

2 (M. C. Z. 30836–7) Ipemi, Uzungwe Mtns. 7. i. 30.

Distribution. The above constitute the first records for the occur-

rence of this West African species in East Africa. Salimu, who assisted me in catching them, reported seeing one which escaped him at Tandala, Ukinga Mountains on 11. ii. 30.

Variation. After careful comparison with a female from Caconda, Angola in the collection of the Museum of Comparative Zoölogy, I can see no grounds for separating the Tanganyika specimens from the Angolan. The type of *I. tanganicana* Boulenger was examined in London and is quite distinct.

Midbody scale-rows (including ventrals) 34–37; transverse ventral rows 24; gular series 24; femoral pores 12–13.

Coloration in life. Realizing that this beautiful lizard was new to the Tanganyika fauna, a detailed description of its coloration was made in the field. Above, head deep brown; back olive, on either side of a faintly indicated, light vertebral line are a series of bright chestnut-brown squarish blotches whose outer edges are touched with black and sometimes a little white, anteriorly these blotches tend to coalesce; a light (anteriorly it is tinged with yellowish) dorso-lateral line has its origin near the last supraocular and disappears on the base of the tail; below it is another series of blotches which are rather more black than chestnut-brown and having the appearance of ocelli by reason of a bluish-white central spot in each; a white band along the upper labials becomes bright yellow behind the eye, passes across the ear-opening and (beneath the black blotches) along the flank to the hind limb, having become whiter between the fore and hind limbs; it is bounded below by a vermilion line commencing on the lower labials and passing along the flank to the hind limb but interrupted by the fore limb. Below, china-white except the regenerated portion of the tail which is brown.

Measurements. The larger of these two males is 143 (59+84) mm.

Diet. A cricket was in the stomach of one of these lizards.

Defence. When captured one gave a faint squeak or chirp, both gaped widely showing the scarlet edges and black interstices of their mouths.

Habitat. Both were taken running about in short grass on either side of the path on the northern ascent to the village.

Ichnotropis squamulosa Peters

Ichnotropis squamulosa Peters, 1854, Monatsb. Akad. Wiss. Berlin, p. 617: Tete, Mozambique; Peters 1883, Reise nach Mossamb., **3**, p. 49, pl. viii, fig. 2; Boulenger, 1921, Monogr. Lacertid., **2**, p. 191.

2 (M. C. Z. 30839–40) Unyanganyi, Turu. 4. xii. 29.
1 (M. C. Z. 30838) Kitungulu, Urungu. 15. v. 30.

Distribution. These records extend the range of this most northerly representative of the genus much further north as the only two localities in Tanganyika Territory from which it is known are Kakoma and the Makonde Plateau.

Variation. Midbody scale-rows (including ventrals) 46–54; transverse ventral rows 26–28; gular series 28; femoral pores in adult 13, indistinctly developed in the two young from Unyanganyi but apparently 8–10, though the range is 13-16.

Coloration. The upper aspect of the adult agrees well with Peters' fine colored plate; below it was lemon-yellow in life. The young have a light pinkish-white, lateral line which unites with its fellow posteriorly to merge into the straw-coloring of the tail, thus presenting a very different appearance to that of the adult.

Measurements. The adult female measured 191 (67+124) mm., a young one 104 (37+67) mm.

Breeding. The female recorded by Tornier from Kakoma was said to have large eggs in its ovary on May 6th, the female from Kitungulu, taken on the 15th of the same month, holds 11 eggs approximately 10 x 7 mm.

Diet. In addition to a mealworm, the stomach of the adult was distended with beetles.

Habitat. At Unyanganyi found in dry thorn-bush steppe. Near Kitungulu, on the Kitungulu to Kasanga trail, three of these lizards were seen. So rapid were their movements that they were not observed until they had dashed off the path into the long grass and scrub which bordered the track. The one secured was shot in the early morning as it paused for a second before taking refuge in a thicket.

Eremias spekii spekii Günther

Eremias spekii Günther, 1872, Ann. Mag. Nat. Hist. (4), **9**, p. 381: Unyamwezi, Tanganyika Territory; Boulenger, 1921, Monogr. Lacertid. **2**, 235;
Eremias spekii spekii Loveridge, 1929, U. S. Nat. Mus. Bull. 151, p. 64: Localities in Kenya Colony.

1 (M. C. Z. 30811) Miritini, Kenya Colony. 30. x. 29.
1 (M. C. Z. 30812) Dodoma, Ugogo. 25. xi. 29.
46 (M. C. Z. 30813–31) Unyanganyi, Turu. 3–4. xii. 29.
4 (M. C. Z. 30832–5) Mangasini, Usandawi. 13. xii. 29.

Distribution. Also seen, though scarce, on Mombasa Island; the

mainland opposite Kilindini; and at Changamwe, all in Kenya Colony. Not common at Miritini, very abundant in the sandy stubble fields of Unyanganyi, Mangasini and at Kikuyu, near Dodoma.

Native name. Lambela (Kisandawi).

Variation. Only two in the whole series had the subocular excluded from the lip (No. 30813 and duplicate) and then on the left side only.

Parasites. Nematodes (*Oxyuroidea sp.* ♀) were present in an Unyanganyi lizard.

Enemies. One was recovered from the stomach of a snake (*Rhamphiophis rostratus*) and another from a *Psammophis subtaeniatus.*

GERRHOSAURIDAE

Gerrhosaurus major major Duméril

Gerrhosaurus major Duméril, 1851, Cat. méthod. coll. Rept., Paris, p. 139: Zanzibar.

Only one was seen during the expedition, this was among rocks on a hill in the centre of the town of Mwanza, Lake Victoria.

Gerrhosaurus major zechi Tornier

Gerrhosaurus maior zechi Tornier, 1901, Beiheft, Arch. Naturg., **67**, p. 74: Kete Kratje, Togoland.

30 (M. C. Z. 30841–55) Mangasini, Usandawi. 13. xii. 29.
1 (M. C. Z. 30856) Dodoma, Ugogo. 23. xii. 29.

Distribution. Recorded from the Belgian Congo by Schmidt (1919), from Morogoro and Dodoma in Tanganyika by Loveridge (1920) and from Kenya Colony (1929, U. S. Nat. Mus. Bull. 151, p. 66 for discussion on status).

Native name. Kinhotei (Kisandawi).

Variation. Midbody dorsal scale-rows 17–20 longitudinal rows; transverse dorsal rows 32–36; longitudinal ventral rows 10; femoral pores 12–18; a single frontonasal separated from the rostral. These figures are based on 14 Mangasini and 2 Dodoma specimens.

Coloration. This form can only be separated from *major typica* by color but the two present a very different appearance in this respect. In life some *zechi* had blue throats and a lateral band of red.

Yellow-brown above; white beneath . . . . *G. m. major*
Buff above, the centre of every scale black; pinkish-white beneath, the centre of every scale (except gulars) dark brown presenting a striped appearance . . . . *G. m. zechi*

Measurements. The largest measured 545 (225+320) mm.

Diet. Every one of 22 Mangasini lizards examined were found to have fed upon winged termites.

Parasites. All harbored nematodes (*Physaloptera sp.*), and some cestodes (*Oochoristica zonuri*).

Habitat. These big girdled-lizards live among the piled-up rock masses of the kopjes which are like so many islands in the semi-desert thorn-bush steppe. As our arrival at Mangasini coincided with the breaking of the rains and the flighting of the termites the reptiles were probably more in evidence than at other seasons. To shoot them would have shattered their tails and our attempts to capture them merely made us feel foolish for the creatures crept into their ledges till they were out of reach and often lay there. I explained the position to the small Wasandawi boys who, with the aid of their dogs and padded arrows, promptly secured the above series in a little more than twenty-four hours.

Gerrhosaurus flavigularis flavigularis Wiegmann

Gerrhosaurus flavigularis Wiegmann, 1828, Isis, p. 379: "Africa merid. Krebs."

2 (M. C. Z. 30857–8) Mangasini, Usandawi. 13. xii. 29.
5 (M. C. Z. 30859–60) Ukerewe Id., Lake Victoria. 11. vi. 30.

Distribution. Another was seen on the western bank of the Ruvu River about twelve miles from Bagamoyo.

Variation. Midbody dorsal scale-rows 22–24 longitudinal rows; transverse dorsal rows 57–62; longitudinal ventral rows 8; femoral pores 15–20; lateral scales keeled; prefrontals broadly in contact.

Measurements. The largest measured 467 (170+297) mm.

Parasites. A tick was found on the throat of a Mangasini lizard.

SCINCIDAE

Mabuya maculilabris (Gray)

Euprepis maculilabris Gray, 1845, Cat. Liz. Brit. Mus., p. 114: West Africa.

Mabuia maculilabris Boulenger, 1887, Cat. Liz. Brit. Mus., **3**, p. 164, pl. ix, fig. 2: West Africa; Ambriz, Angola; Angasija, Great Comoro Islands; Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 157: West, Central and East Africa, 14 localities.

1 (M. C. Z. 31002) Bagamoyo, 11. xi. 29.
51 (M. C. Z. 30861–85) Mwaya, Lake Nyasa. 1–8. iii. 30.

1 (M. C. Z. 30886) Nyamkolo, Lake Tanganyika. 9. v. 30.
1 (M. C. Z. 30887) Kitungulu, Urungu. 15. v. 30.
1 (M. C. Z. 30888) Kasanga, Lake Tanganyika. 16. v. 30.
4 (M. C. Z. 30889–92) Ujiji, Lake Tanganyika. 28. v. 30.
1 (M. C. Z. 30893) Ukerewe Id., Lake Victoria. 14. vi. 30.
1 (M. C. Z. 30894) Entebbe, Lake Victoria. 27. vi. 30.
1 (M. C. Z. 30895) Jinja, Lake Victoria. 30. vi. 30.
11 (M. C. Z. 30896–902) Mabira Forest, Uganda. 1. vii. 30.

Native name. Ulusakani (Kinyakusa for *Mabuya*).

Variation. Midbody scale-rows 30–34; keels on dorsal scales 3–9, normally 5; supraciliaries 3–7, normally 5; prefrontals in contact in 17 specimens, separated in 31, in one skink (No. 30901) this is due to the presence of an interprefrontal scale which also separates the frontal from the frontonasal, this is also the only skink with 3 supraciliaries; supranasals in contact in 28 specimens, forming an "X" in two, separated by the rostral and frontonasal in 17.

Arranging this data by locality, as was done in Barbour and Loveridge's 1928 paper, it would read as follows:—

Locality	*Number of skinks*	*Greatest head and body in mm.*	*Longest tail in mm.*	*Mid-body scale-rows*	*Number of supraciliaries*	*Keels on scales*
Bagamoyo...	1	78	135	31	5	9
Mwaya......	25	83	158	30–32	5–7	7
Nyamkolo...	1	71	133	30	5	7
Kitungulu...	1	73	–	30	5	7
Kasanga.....	1	64	106	32	6–7	7
Ujiji.........	4	80	169	32–34	5	7–9
Ukerewe.....	1	83	132	32	5	7
Entebbe.....	1	60	125	32	5	3–7
Jinja.........	1	56	121	32	5–6	3–5
Mabira......	11	90	173	30–32	3–5	5–7

This fairly long series was collected in the hope of throwing light on the relationship of *M. maculilabris* to *M. comorensis;* a study of the material leaves me in a greater quandary than ever; at most *comorensis* appears to be a race of *maculilabris*. Undoubtedly Amani *comorensis* average much larger than *maculilabris*, they are stouter and occasionally have a higher number of midbody scale-rows (34–38), the type from Comoro Islands had 36. Whether the size of the Amani skinks is due to abundant food and congenial climatic conditions seems possible for the Central African *maculilabris* are almost as large. A really

difficult problem awaits solution. Apparently *Mabuya maculilabris* is a skink that reacts readily to its environmental conditions and produces color forms which are ill-defined when long series are available, yet are very striking and often of a characteristic type in a given locality.

The Entebbe and Jinja specimens, though similar in color and markings to the skinks from the Mabira Forest, which lies about midway between Entebbe and Jinja, differ from all the others in the series in possessing 3 very strong keels, occasionally with an outer indistinct pair, to the dorsal scales.

Having examined Boulenger's series of Ruwenzori *M. maculilabris* I find them specifically identical with the British Museum series of *M. comorensis* from Johanna Island.

Coloration. The Bagamoyo skink is similar in color to Sternfeld's *M. boulengeri* from Makonde highlands and very different to all the others in the series except the Kitungulu specimen which approximates to it dorsally.

The Mwaya series came from just across the lake to Old Langenburg, type locality in part of *M. m. rohrbecki* Sternfeld.

The Ujiji specimens are undoubtedly *M. m. major* Sternfeld from the Central Lake Region and which is the best marked of all the forms geographically. In life the coloring was very rich, much reddish-orange above and lemon-yellow below.

The throat and flanks of the skink from Ukerewe Island were tinged with magenta (not unlike the shade of *Agama a. mwanzae* which was plentiful on the island) while the breast and only the central line of the belly were yellowish.

It might be added that the coloring of the Mwaya, Nyamkolo, Kitungulu and Kasanga specimens was so similar to that of a Frere Town *comorensis* that I unhesitatingly referred them all to that species in the field. (vide. Proc. Zoöl. Soc. London, 1923, p. 956).

Measurements. The largest specimen (No. 30896) measures 260 (90+170) mm.

Diet. In the stomach of one Mwaya skink was a snail, cockroach, two crickets and a caterpillar.

Enemies. One recovered from the stomach of a Hissing Sand-Snake (*Psammophis sibilans*) at Mwaya.

Habitat. The Bagamoyo lizard was collected on, or at the base of, a banana; another was seen outside its hole in the stem of a coconut palm. At Mwaya I took five among some dry thatching grass which had been piled on a trestle, showing these to the native children I

offered the equivalent of one cent (U. S. currency, i.e. 5c Tanganyika) and had fifty skinks brought in the following day though I should have said that they were decidedly uncommon! At Kasanga they are not uncommon and by no means rare on the rocks at the water's edge where they occupy the niche usually filled by *M. v. varia*. They were not seen on the Bangwe rocks near Ujiji; the specimens from Ujiji were captured on the thatch of a native hut. The Jinja lizard lived in a hole in a tree trunk and I saw an *M. striata* basking at the same time upon the bole. When first seen the Nyamkolo skink was also basking on a hollow tree trunk but escaped me. Later I returned and was surprised to see a full-grown *M. planifrons* basking right beside the *M. maculilabris*, they were not separated by half-an-inch and the same shot killed them both. These instances of members of the same genus occupying the same territory is of no small interest. The series from Mabira Forest were taken on, or under, logs and in the grass at the edge of paths at the forest edge.

Mabuya planifrons (Peters)

Euprepes (*Euprepis*) *planifrons* Peters, 1878, Monatsb. Akad. Wiss. Berlin, p. 203, pl. ii, fig. 2: Taita, Kenya Colony.

Mabuia diesneri Sternfeld, 1911, Sitzber. Ges. Naturf. Freunde Berlin p. 248: Kibwezi, Kenya Colony.

5 (M. C. Z. 30903–7) Saranda, Ugogo. 30. xi. 29.
2 (M. C. Z. 30908–9) Unyanganyi, Turu. 4. xii. 29.
1 (M. C. Z. 30910) Mangasini, Usandawi. 13. xii. 29.
4 (M. C. Z. 30911–3) Nyamkolo, Lake Tanganyika. 9. v. 30.

Distribution. Nieden has recorded *diesneri* from Usumbura and Tabora and the present writer from Tabora, Izikisia, Ulugu and Ndogwe but under the earlier name of *planifrons*.

Native name. Mbutlanga (Kisandawi).

Variation. Midbody scale-rows 29–32; dorsal keels 3–5, usually 3 with 5 anteriorly; ear lobules 3–4; frontal in contact with the 2nd and 3rd supraocular; prefrontals in contact; postnasal in contact with the 2nd labial in 4 specimens, and in contact on one side only in the remaining 4; the toes of the adpressed hind limb reach the toes of the fore limb in the two largest skinks, in the others they reach to the wrist.

Coloration. The two rows of irregular black spots present in the young are absent in the adults; the dark brown lateral band so well-defined anteriorly becomes indistinct about midbody and may be with or without white flecks.

Measurements. The largest skink (No. 30908) measures 350 (125+225) mm.

Diet. Stomachs examined, held (1) an adult yellow migratory locust in an Unyanganyi skink, (2) flighting termites in the Mangasini reptile.

Parasites. Nematodes (*Strongyluris brevicaudata*) were preserved from the stomach of an Unyanganyi specimen.

Habitat. The Saranda skinks were all collected on tree trunks or fallen logs. The species is really rather common there though one might walk for days in the bush without seeing one. This is due to the sharp sight of the skinks which, seeing a person approaching from afar, dart round their tree trunk or take refuge in a hole. Further they are fond of basking head-downwards just about a foot from the ground, this is usually beneath the grass line and there is frequently a fissure or hole in the ground into which they can flee. One of the two skinks secured at Unyanganyi ran up a tree to escape. The Mangasini reptile was taken on a branch of an acacia shrub.

Mabuya megalura (Peters)

Euprepes (*Mabuia*) *megalura* Peters, 1878, Monatsb. Akad. Wiss. Berlin, p. 204, pl. ii, fig. 4: Taita, Kenya Colony.

1 (M. C. Z. 20914) Bagamoyo. 11. xi. 29.
11 (M. C. Z. 20915–6) Ilolo, Rungwe. 17–22. iii. 30.
1 (M. C. Z. 20917) Ukerewe Id., Lake Victoria. 12. vi. 30.
1 (M. C. Z. 20918) Nairobi, Kenya Colony. 5. vii. 30.

Native name. *Ulusakani* (Kinyakusa for *Mabuya*).

Variation. Midbody scale-rows 24–26, normal for the species.

Measurements. The largest skink (No. 20917) measures 224 (60+164) mm.

Diet. The stomachs of seven Ilolo skinks were examined, one was empty, all the rest held spiders, the only other recognisable remains being of a very small grasshopper. It would appear as if this skink has a specialized diet as well as unusual habits.

Habitat. The Bagamoyo specimen was caught in a swamp eight miles west of the town, another was seen climbing through the grass tops with astonishing agility.

Mabuya varia varia (Peters)

Euprepes (*Euprepis*) *varius* Peters, 1867, Monatsb. Akad. Wiss. Berlin, p. 20: Tete, Mozambique.

Mabuya varia Loveridge, 1929, U. S. Nat. Mus. Bull. 151, p. 74: Kenya and Uganda localities — discussion.

1 (M. C. Z. 30911) Bagamoyo. 11. xi. 29.
5 (M. C. Z. 30920–21) Unyanganyi, Turu. 3. xii. 29.
1 (M. C. Z. 30922) Handa, Usandawi. 10. xii. 29.
7 (M. C. Z. 30923–5) Mangasini, Usandawi. 12. xii. 29.
3 (M. C. Z. 30926–8) Dabaga, Uzungwe Mtns. 1. i. 30.
1 (M. C. Z. 30929) Ipemi, Uzungwe Mtns. 7. i. 30.
9 (M. C. Z. 30930–5) Kigogo, Uzungwe Mtns. 13. i. 30.
1 (M. C. Z. 30936) Lukungu, Ubena Mtns. 8. ii. 30.
1 (M. C. Z. 30937) Ihenye, Ukinga Mtns. 8. ii. 30.
2 (M. C. Z. 30938) Mangoto, Ukinga Mtns. 10. ii. 30.
9 (M. C. Z. 30939–42) Tandala, Ukinga Mtns. 11. ii. 30.
8 (M. C. Z. 30943–5) Madehani, Ukinga Mtns. 19. ii. 30.
7 (M. C. Z. 30946–9) Ilolo, Rungwe, 22. iii. 30.
55 (M. C. Z. 30950–75) Igale, Poroto Mtns. 30. iv. 30.
7 (M. C. Z. 30976–7) Nyamkolo, Lake Tanganyika. 9. v. 30.
3 (M. C. Z. 30978–9) Kitungulu, Urungu. 15. v. 30.
2 (M. C. Z. 30980–1) Kasanga, Lake Tanganyika. 16. v. 30.
1 (M. C. Z. 30982) Kipili, Lake Tanganyika. 19. v. 30.
1 (M. C. Z. 30983) Ujiji, Lake Tanganyika. 28. v. 30.
1 (M. C. Z. 30984) Mwanza, Lake Victoria. 6 vi. 30.
1 (M. C. Z. 30985) Ukerewe Id., Lake Victoria. 10. vi. 30.

Distribution. Also seen on rocks in the river bed at Kilimatinde and on rocks on a hillside at Saranda.

Native names. *Milenga* (Kisandawi); *fuiwinyomo* (Kihehe); *limvidunu* (Kihehe at Kigogo); *mtzubu* (Kikinga); *luwinzo* (Kirungu); *nsioli* (Kifipa).

Affinities. It was confidently hoped that specimens comparable to *Mabuya brauni* Tornier would be secured in the Ukinga Mountains where the holotype was collected by Dr. Fülleborn thirty years ago; these expectations were not fulfilled, however, as only typical *varia* were collected there.

M. brauni was differentiated from *varia* on three characters:—

(1) Dorsal scales bicarinate.
(2) Subocular reaches the mouth but strongly narrowed.
(3) Color as in *varia* but lacking the longitudinal stripes.

The material listed above, shows:—

(1) Dorsal scales tricarinate, occasionally a few quinquecarinate.
(2) Great variation is exhibited by the suboculars which broadly border the mouth, narrowly border the mouth, or are *entirely excluded* on both sides of the head in one Tandala

skink, or on one side only in a Tandala and an Unyanganyi specimen.

(3) During the week spent at Ilolo, some sixty miles from the Ukinga Mountains, I saw two *varia* which, in their uniform brown or olive-green color with entire absence of markings, were similar to those which I have recorded from the Aberdare Mountains and Northern Guaso Nyiro in Kenya Colony.

One of these is M. C. Z. 30590, the other was too badly damaged to be worth preserving.

It is clear then that *brauni* can only be distinguished from *varia* by the former's bicarinate scales, it is probably a variant like the one or two examples with quinquecarinate scales found in this long series. For the present it seems advisable to retain the name as a subspecies of *varia* until more material from the Ukinga Mountains is available.

Variation. A pair of frontoparietals, subocular usually bordering the lip broadly, or very narrowly, or excluded from it entirely in 2% of this series; ear lobules generally short, in fact almost indistinguishable in some of the mountain specimens, but long in those from the arid thorn-bush country of Unyanganyi and Usandawi though none so long as in a paratype of *M. varia longiloba* Hewitt, which is probably synonymous with *M. varia damaranus* (Peters)

Coloration. See remarks under affinities.

Measurements. The largest skink (No. 30951) measures 186 (77+109) mm.

Breeding. The Ipemi female was gravid on January 7, 1930.

Diet. Beetles present in the stomach of a Kigogo skink.

Parasites. Female oxyuroids were removed from an Unyanganyi skink.

Enemies. One was recovered from the stomach of a *Lycophidion capense uzungwensis* at Kigogo and five from as many specimens of *Trimerorhinus tritaeniatus* at Dabaga, Kigogo and Igale.

Habitat. When rocks are available they are favored by the Variable Skink; such was the case at Unyanganyi, Dabaga, Kigogo, Ipemi, Mwanza, Kasanga and Bangwe near Ujiji. At the last two places the rocks were on the lake shore. At Kigogo, where rocks were very scarce, it was interesting to observe the adaptation of this skink to a different environment; the few rocks were occupied, but the majority of skinks lived in the long grass, basking on dry patches of it and rustling away so quickly on one's approach that a glimpse of one was rarely obtained. At Igale these skinks were found dwelling in holes in the high earth

bank which constitutes part of the cutting flanking the road. I shot the head of one which was protruding from a hole and on withdrawing the undamaged specimen found that it was uniformly brown and devoid of markings, yet in other holes to the right and left of it typical *varia* were secured. I therefore instructed my headman to purchase fifty of these skinks at 5 cents each (about 1 cent U. S. currency), the total desired were brought in within twenty-four hours but only one was similar to the variant which I had secured and it was somewhat of an intermediate as it showed faint traces of markings on the sides of the head and flanks. Just before leaving Igale I saw a second skink entirely devoid of markings. It had been basking on the side of my tent and descended to the ground as I approached; it was moving away through a tangle of grass when I shot it but was too close so that the remains were not worth preserving. Other habitats were fallen trees at Dabaga; dry, open forest at Kitungulu, and sandy flats, cleared for native gardens, at Kipili.

Mabuya striata (Peters)

Tropidolepisma striatum Peters, 1844, Monatsb. Akad. Wiss. Berlin, p. 36: Mozambique.

Mabuia striata Boulenger, 1887, Cat. Lizards Brit. Mus., **3**, p. 204: Zanzibar; Zambesi; South Africa; Damaraland.

1 (M. C. Z. 30986) Bagamoyo. 8. xi. 29.
4 (M. C. Z. 30987–9) Unyanganyi, Turu. 4. xii. 29.
2 (M. C. Z. 30990) Tandala, Ukinga Mtns. 11. ii. 30.
1 (M. C. Z. 30991) Mwaya, Lake Nyasa. 1. iii. 30.
6 (M. C. Z. 30992) Ilolo, Rungwe. iii. 30.
1 (M. C. Z. 30993) Tukuyu, Rungwe. 21. iv. 30.
1 (M. C. Z. 30994) Abercorn, N. Rhodesia. 7. v. 30.
1 (M. C. Z. 30995) Kitungulu, Urungu. 15. v. 30.
2 (M. C. Z. 30996) Ujiji, Lake Tanganyika. 28. v. 30.
1 (M. C. Z. 30997) Shinyanga, Usukuma. 3. vi. 30.
1 (M. C. Z. 30998) Ukerewe Id., Lake Victoria. 9. vi. 30.
1 (M. C. Z. 30999) Bukoba, Lake Victoria. 24. vi. 30.
1 (M. C. Z. 31000) Jinja, Uganda. 30. vi. 30.
1 (M. C. Z. 31001) Mabira Forest, Lake Victoria. 1. vii. 30.

Distribution. Also seen at Dodoma, Saranda and Mwanza. Abundant on palms and buildings at Bagamoyo; very common at Tukuyu, Kasanga and Ujiji; scarce at Unyanganyi where it is replaced by *M. planifrons;* scarce at Tandala, Mwaya and Kitungulu, in the last locality *M. v. varia* being very abundant.

Native name. *Mtzuba* (Kikinga); *ulusakani* (Kinyakusa for Mabuya).

Variation. Midbody scale-rows 34–38, several specimens with 38; dorsal scales with 3–5 keels; a pair of frontoparietals.

Measurements. Largest skink (No. 30990) measures 228 (96+132) mm.

Riopa fernandi (Burton)

Tiliqua fernandi Burton, 1836, Proc. Zoöl. Soc. London, p. 62: Fernando Po.

Lygosoma fernandi Boulenger, 1886, Cat. Lizards Brit. Mus., **3**, p. 304: Fernando Po; Nigeria; Cameroon; Gaboon.

3 (M. C. Z. 31005–7) Entebbe, Uganda. 27. vi. 30.

Native name. *Ngurukisi* (Luganda).

Variation. Midbody scale-rows 34. All three agree in every respect with Boulenger's redescription except for these additions:—Supraoculars 5–6; owing to the fusion of the 3rd and 4th upper labials, the 4th and 5th may be below the eye, the 5th labial actually enters the orbital ring on one side of the head in Nos. 31005–6, on the other side it is narrowly separated.

Coloration. Boulenger's description, based on preserved material, makes no mention of the scarlet sides of this big *Gerrhonotus*-like skink.

Measurements. The largest specimen (No. 31005) measures 293 (143+150) mm.

Diet. Much of the stomach contents was indeterminable but the following were found:—A large weevil, two carabid beetles, four hairy caterpillars, one millipede, ten slugs.

Habitat. After sunset on the eve of leaving Entebbe, I was dining in the entrance of my tent when one of these skinks came wriggling through the grass straight towards me. I captured it and tried to bring it back alive but it did not survive the Red Sea.

I captured the first pair in some soft, sandy soil in the base of a rotten stump close to the lake shore. These large lizards are quite inoffensive and rely on violent wriggling to effect their escape, they are extremely difficult to hold on account of their highly polished scales; though their claws are sharp they do not make definite use of them as weapons as does a monitor lizard.

Riopa sundevallii sundevallii (Smith)

Eumeces (*Riopa*) *sunderallii* A. Smith, 1849, Illus. Zoöl. South Africa, **3**, App. p. 11: Natal.

Lygosoma sundevalli Tornier, 1900, Zoöl. Jahrb. Syst., **13**, p. 599: Discussion of East African material.

Lygosoma sundevallii Schmidt, 1919, Bull. Am. Mus. Nat. Hist., **39**, p. 561, pl. xxix: Garamba and Yakululu, Belgian Congo.

1 (M. C. Z. 31008) Miritini, Kenya Colony. 30. x. 29.
16 (M. C. Z. 31009–13) Bagamoyo, 9–12. xi. 29.
1 (M. C. Z. 31027) Kitungulu, Urungu. 15. v. 30.
2 (M. C. Z. 31028–9) Albertville, Lake Tanganyika. 21. v. 30.
3 (M. C. Z. 31032–4) Entebbe, Lake Victoria. 27. vi. 30.

Distribution. Also seen at Changamwe, Kenya Colony.

Affinities. Schmidt was scarcely correct if by stating that Nieden and others united *L. modestum* (Günther) with *L. sundevallii* (Smith) he meant to imply that the former was a synonym. Superficially this would seem to have been their action but in reality both considered it a variety, i.e. subspecies, of *sundevallii*. The Dar es Salaam specimen referred to by Tornier was undoubtedly an aberrant, or intermediate, *sundevallii* and may be matched by one of the Bagamoyo series listed above. I have seen a very large skink from Machakos, Kenya Colony (Nairobi Museum collection) which has the coloring of *sundevallii* but has the supranasal fused with the anterior nasal as in *modestum*.

The two forms may be distinguished as follows:

Supranasal not fused with anterior nasal; size larger.
Back usually much spotted though occasionally
uniform .... *R. s. sundevallii*
Supranasal fused with anterior nasal; size smaller.
Back usually uniform brown, occasionally spotted *R. s. modestum*

Variation. Midbody scales smooth (very faint indications of keeling in a young Bagamoyo skink) in 26–30 rows (30 on No. 31032 only); supranasal distinct; nostril usually between two nasals though an intermediate occurs in both the Bagamoyo and Entebbe series where the anterior is fused to the supranasal; in an Albertville specimen there are three nasals due to a division in one; frontal equals the frontoparietal and parietal together, or is rather longer or shorter; 4th toe longer than the 3rd in all these specimens.

Coloration. Above profusely spotted except the Kitungulu skink which is scarcely spotted and looks like *modestum*. Below uniformly white except one Entebbe skink which is well spotted.

Measurements. The largest skink (No. 31008) measures 200 (118+82) mm.

Diet. Stomach contents of Bagamoyo specimens were: (1) Millipede, (2) termites, a small scarab, and wing cases of a larger beetle, (3) a long-tailed cricket.

Parasites. Nematodes were present in a Bagamoyo skink.

Enemies. The tail of one skink was recovered from the stomach of a *Rhamphiophis rostratus* at Dar es Salaam and a skink from a *Lycophidion capense* × *acutirostre* at Bagamoyo.

Habitat. Very common in sandy soil beneath rubbish at Miritini; abundant under rubbish on the sea coast at Bagamoyo; beneath logs in dry woodland at Kitungulu; beneath bundles of thatching grass at Albertville.

Riopa sundevallii modestum (Günther)

Sepacontias modestus Günther, 1880, Ann. Mag. Nat. Hist. (5), **6**, p. 235: Mpwapwa, Ugogo, Tanganyika Territory.

Lygosoma modestum Lönnberg, 1907, Reptilia and Batrachia in Sjöstedt, 1910, Kilimandjaro-Meru Expedition, **1**, part 4, p. 8: Kibonoto and Ngare na nyuki, Tanganyika Territory.

Lygosoma ferrandii Loveridge (*nec.* Boulenger), 1920, Proc. Zoöl. Soc. London, p. 157: Longido and Dodoma, T. T.; 1923, Proc. Zoöl. Soc. London, pp. 859 and 962: Nine localities in Central Tanganyika Territory; 1928, Proc. U. S. Nat. Mus., **73**, Art. 17, p. 66: Dodoma and Mukwese, T. T.

2 (M. C. Z. 31014–5) Mpwapwa, Ugogo. 23. xi. 29.
2 (M. C. Z. 31016) Saranda, Ugogo. 30. xi. 29.
3 (M. C. Z. 31017–8) Unyanganyi, Turu. 4. xii. 29.
4 (M. C. Z. 31019–22) Handa, Usandawi. 10. xii. 29.
6 (M. C. Z. 31023–6) Mangasini, Usandawi. 12. xii. 29.
1 (M. C. Z. 31030) Mwanza, Usukuma. 6. vi. 30.
1 (M. C. Z. 31031) Bukoba, Lake Victoria. 24. vi. 30.

Distribution. Nieden has recorded this form from the Ubena Highlands.

Affinities. In the arid, sandy, thorn-bush steppe of the Central Tanganyika plateau is a sandy-brown colored skink which looks distinct enough from the large, spotted *sundevallii.* Some were submitted to the British Museum in 1920 and identified as *ferrandii,* a name that I have applied to them ever since. Passing through London on my way to East Africa I was afforded the opportunity of examining the type of *ferrandii* which, as I had begun to suspect, was a different creature from the one to which I had been applying the name. In accordance with my plans I visited Mpwapwa and was able to secure topotypes of *modestum* which is the correct name to apply to these skinks from the Central plateau. I regard it as a race of *sundevallii* (of which Parker considers *ferrandii* a synonym) because of intermediates occurring at Machakos, Karungu Bay, Entebbe etc.

Variation. Based on 27 specimens from 12 localities in Tanganyika.

Midbody scale-rows smooth in 24–28 rows, all but five skinks have 26; supranasal is fused with the anterior nasal so that the nostril is between the supranasal and a small nasal; frontal usually equals frontoparietal and parietal together but is shorter in six specimens.

Coloration. Adults are uniformly yellowish brown or dark brown above except for the tails which are usually spotted, one adult (No. 31016) has retained the spotting of the juveniles which, in addition to the dorsal spotting sometimes possess a dark lateral band. Ten miles east of Unyanganyi a unique specimen (No. 31018) was taken under a log lying on red soil, this skink was uniformly red beneath and the color is retained even after two years' immersion in formalin and alcohol.

Measurements. The largest skink (No. 18689) is from Ikikuyu and measures 180 (95+85) mm., but this is an exceptionally large individual, and much above the average.

Enemies. At Mangasini one skink was recovered from the stomach of a *Coronella semiornata* and two from *Psammophis biseriatus.*

Habitat. The Mpwapwa skinks were taken in sandy soil under a rotting tree stump in the bank of a dry stream-bed. Saranda and Handa specimens were all found beneath logs. At Unyanganyi among dead leaves at the base of a bush. They were most numerous at Mangasini where at least a dozen were seen in the course of a twenty minutes' walk over a kopje after sunset, at which time they emerge from their retreats and wriggle about.

ABLEPHARUS BOUTONII AFRICANUS Sternfeld

Ablepharus peronii Peters (*nec.* Cocteau), 1854, Verh. Akad. Wiss. Berlin, p. 619: Cabaçeira, Mozambique.

Ablepharus boutoni africanus Sternfeld, 1918, Abh. Senckenb. Nat. Ges., **36**, p. 423: Manda Island, Malindi and Pemba Island.

Cryptoblepharus boutonii peronii Loveridge (*nec.* Cocteau), 1929, U. S. Nat. Mus. Bull. 151, p. 80: discussion on races.

26 (M. C. Z. 31036–45) Dar es Salaam. 6. xi. 29.

Affinities. Mertens has recently (1931, Zoöl. Jahrb. Syst., **61**, pp. 63–210) made a very thorough revision of all the races of *boutonii* and shown that *Cryptoblepharus* cannot be retained as a distinct genus. As he considers *africanus* a valid race I accept his decision.

Variation. Midbody scale-rows 22–24, with an average of 23 for the whole series.

Measurements. The largest skink measures 114 (42+72) mm., but

is exceeded in body length by one of 107 (48+59) mm., both are slightly surpassed by some which I recorded in 1920.

Breeding. Most, or all, of the females have the ovules enlarged and measuring up to 10 x 5 mm.

Ablepharus wahlbergii (Smith)

Cryptoblepharus wahlbergii Smith, 1849, Illus. Zoöl. S. Africa, **3**, App., p. 10: Natal.

Ablepharus wahlbergii Loveridge, 1929, U. S. Nat. Mus. Bull. No. 151, p. 79: Nairobi and Mt. Kenya, Kenya Colony.

15 (M. C. Z. 31046–54) Bagamoyo. 9–12. xi. 29.
3 (M. C. Z. 31055–7) Mpwapwa, Ugogo. 23. xi. 29.
3 (M. C. Z. 31058–60) Masiliwa, Turu. 10. xii. 29.
3 (M. C. Z. 31061–3) Kitungulu, Urungu. 15. v. 30.
1 (M. C. Z. 31064) Nyamkolo, Lake Tanganyika. 9. v. 30.

Distribution. Seen also at Mangasini and Kasanga.

Variation. Midbody scale-rows 22–28, this astonishing range was to be found in the Bagamoyo series alone as well as elsewhere, the average of twenty-one skinks is 25 scale-rows; the normal number of 3 supraoculars is present in every skink.

The Nyamkolo specimen, which also has 28 scale-rows, looks so different from any *wahlbergii* that I have ever seen that I felt confident in the field that it represented a different species. Examination in the laboratory, however, shows that the head shields and all other characters are normal so that it must be its large girth and strange coloring that produce the illusion.

Coloration. An Mpwapwa skink had the throat white but the rest of the lower surface salmon-red. The Nyamkolo skink had the throat spotted.

Measurements. The Nyamkolo skink measures 83 (50+33) mm., its tail being regenerated; the next largest specimen (No. 31049) measures 94 (45+49) mm.

Breeding. At Bagamoyo the females held large ova, at Mpwapwa two eggs and a young one were unearthed among the rotting roots of a large tree-stump in the sandy soil of a dry stream-bed. Two of these eggs hatched as I picked them up and young ones, measuring 34 (17+17) mm., wriggled out. I had always supposed the species to be viviparous like the majority of skinks. At Masiliwa two very small young, perhaps a few weeks old, were taken after sunset as they were running about in a drift of dry leaves at the base of a bush.

Enemies. At Bagamoyo two and four tails were recovered from the stomachs of *Lycophidion capense* >< *acutirostre* and *Philothamnus s. semivariegatus* respectively.

Habitat. Very abundant among grass roots on sandy soil at Bagamoyo; among fallen leaves under a mango tree at Mpwapwa; an adult under a log at Masiliwa; on rocky kopje at Mangasini; both in dry woodland and among dry leaves in a remnant of rain forest at Kitungulu. It was apparently this species which was several times seen running over rocks near the water's edge of Lake Tanganyika at Kasanga and elsewhere.

Ablepharus megalurus Nieden

Ablepharus megalurus Nieden, 1913, Mitt. Zoöl. Mus. Berlin, **7**, p. 89: Kinjanganja in Turu, 4° 50's., i.e. Unyanganyi, Turu, Tanganyika Territory.

8 (M. C. Z. 31065–9) Mangasini, Usandawi. 14. xii. 29.
5 (M. C. Z. 31070–4) Saranda, Ugogo. 18. xii. 29.

Distribution. Hitherto only known from the holotype, Saranda is exactly fifty miles due south of Unyanganyi, Mangasini lies between the two but about fifteen miles east.

Variation. Midbody scale-rows 20–22, apart from this the series agrees very closely with the original description except in one particular which may be translated thus, "Through their entire length the paired frontoparietals separate from the interparietal," I imagine that this was intended to read, "Through their entire length the paired frontoparietals separate the frontal from the interparietal" for this is the arrangement in my specimens which are *megalurus* beyond any shadow of doubt.

Coloration in life. Naturally this differs somewhat from Nieden's description based on an alcoholic specimen though the markings correspond. Above, bronze, from each eye or nuchal scale, a light silver line edged above and below by black, extends to the root of the tail; owing to the centre of each scale being darker in some individuals such specimens have the appearance of dusky lateral stripes corresponding to the scale-rows; tail vivid pale blue, more or less longitudinally striped. Below, satiny-white or tinged with blue; throats of three of the larger specimens darker.

Measurements. The largest skink measures 92 (32+60) mm., and the smallest 49 (20+29) mm., both from Mangasini. This is undoubtedly the smallest species of lizard inhabiting East Africa.

Habitat. When on the way to Unyanganyi for the sole purpose of

securing a topotypic series of this skink, we were delayed at Saranda several days. The country was very desiccated and, on November 28th, having just shot an owl after sunset, I was hurrying back to the road with a gun in one hand and the owl in the other. Salimu came to meet me just as I was about to jump a shallow trench, at the same instant I saw a skink scuttle over the edge of the trench and disappear into one of the numerous fissures of the sun-baked black cotton soil. I recognised it as a species new to me but, though we returned to the place at all hours of the day and Salimu searched the trench for a hundred yards in either direction we never saw the reptile again.

At Unyanganyi, this time the sun was low but had not quite disappeared, I saw a second specimen which vanished into a mere slit of similar soil at the base of a bush in a desiccated *mbugwe*. Next day, despite the almost iron-like hardness of the ground we dug up the whole vicinity to the depth of a foot without meeting with any success.

Shortly after we reached Mangasini the long-delayed rains broke and the baked plains below the camp began to flood. Salimu returned with the first pair of these skinks and by showing them to all the native children that visited camp and offering the high price of twelve cents (U. S. currency) six more were secured. It is next to impossible for a white man to capture these elusive little creatures by reason of their unusual habitat. They live in the fissures of the cracked soil, such fissures often being six feet or more in depth; they usually bask on the *sides* of the fissures (by which I mean within the crack) in the early morning or late afternoon at which times the sun strikes obliquely. So wary are these reptiles that they run down the fissure as soon as a shadow falls upon them and by stalking I could never get within six feet.

At Saranda, Salimu, assisted by Abedi, spent the greater part of a day hunting *megalura* and only succeeded in capturing five. These were got by wriggling up to the point above where the skink had been seen and dabbing a wad of soft material over the reptile, the edge of the cloth was then turned back with care until the specimen was located and its head or neck grasped with a forceps, even so a large proportion parted with their tails.

Melanoseps ater (Günther)

Herpetosaura atra Günther, 1873, Ann. Mag. Nat. Hist. (4), **12**, p. 147: Zambesi; Peters, 1882, Reise nach Mossamb., **3**, p. 81.

Melanoseps ater Boulenger, 1887, Cat. Lizards Brit. Mus., **3**, p. 422.

Melanoseps ater var. *longicauda* Tornier, 1900, Zoöl. Jahrb. Syst., **13**, p. 602; Masailand & Korogwe, Tanganyika Territory; Loveridge, 1923, Proc. Zoöl. Soc. London, p. 963: Mkata Station, Tanganyika Territory.
Melanoseps ater longicauda Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 169: Vituri, Uluguru Mtns., Tanganyika Territory.

1 (M. C. Z. 31075) Mpwapwa, Ugogo. 22. xi. 29.
2 (M. C. Z. 31076–7) Kigogo, Uzungwe Mtns. 23. i. 30.

Affinities. This additional material confirms the opinion expressed in 1928 that Tornier's *longicauda* was not specifically distinct from *ater*. In all probability the type of *ater* was a female and that of *longicauda* was a male, hence the longer tail.[1] Arranged from south to north the available data is as follows:—

	Locality	*Sex*	*Length of head and body*	*Length of tail*	*Tail into H & B*	*Mid-body scale-rows*
Type of *ater*	Zambesi River	? ♀	160 mm.	43 mm.	3.72	22
M. C. Z. 31076	Kigogo	♀	108 "	28 "	3.85	26
" 31077	"	♀	210 "	–	–	28
" 31075	Mpwapwa	♀	87 "	28 mm.	3.10	20
" 18356	Mkata Station	♀	82 "	30 "	2.73	18
" 24235	Vituri	♂	124 "	–	–	22
Cotypes of	Korogwe	?	52 "	–	–	19
longicauda	Masailand	? ♂	71 "	41 mm.	1.73	19

Coloration in life. Based on the larger Kigogo female. Above, and on sides, uniformly steely-blue-black. Below, white, each scale with a black centre thus giving the appearance of about a dozen longitudinal lines from throat to anus but on the tail forming a diamond-shaped pattern.

Breeding. Ovules small.

Diet. A large caterpillar in the stomach of one Kigogo skink.

Habitat. The Mpwapwa specimen was taken in sandy debris among the rotten roots of a fallen tree fifty feet from a stream, though the actual site was bone-dry. The Kigogo skinks were taken by natives engaged in clearing the vegetation from black alluvial soil on a grass-grown hillside at the very edge of the temperate rain forest.

[1] I asked Mr. H. W. Parker for further information on this point and after examining the type, he replied: "It has not been dissected but is apparently a female; the tail looks as if it *may* have been injured, but I should not like to say definitely that it had; there are one or two minor irregularities of the scaling just where it rounds off for the tip; there is no terminal scute, but this looks like a postmortem loss and not due to an injury in life.

ANELYTROPIDAE

Feylinia currori elegans (Hallowell)

Acontias elegans Hallowell, 1852, Proc. Acad. Nat. Sci. Philad., p. 64: Liberia (? Gaboon, *fide* K. P. Schmidt).

1 (M. C. Z. 31078) Entebbe, Lake Victoria. 27. vi. 30.

Distribution. *Feylinia currori* (whether *elegans* or the typical form I cannot say) has been reported by Boulenger from the Sesse Islands in Lake Victoria and by Nieden from Bukoba on the western shore of the lake; the present record appears to be the most easterly published but there are three Entebbe examples collected by Sir Harry Johnston (1900) and Hoare (1929) in the British Museum collection.

Affinities. *F. elegans* was tentatively referred to the synonymy of *F. currori* by Boulenger in 1896 (Cat. Lizards Brit. Mus. **3**, p. 431) but in 1919, Schmidt (Bull. Am. Mus. Nat. Hist. **39**, p. 605) after studying the type and other examples, proposed recognising *elegans* as a species which differs from *currori* in having the ocular in contact with the second labial (third in *currori*) and cut off from the third by a post-ocular.

Mr. H. W. Parker has kindly sent me the following information based on fifteen specimens in the British Museum. Of these, four are from Entebbe and Msori, Uganda and agree in having the eye in contact with the second labial which, he remarks, appears to correspond to a fusion of the first and second in the others; eleven West Coast (Nigeria, Cameroon, French Congo, Gaboon and Angola) specimens agree with the two *currori* (Cameroon and Belgian Congo) in the Museum of Comparative Zoölogy in having the eye in contact with the third labial. The distribution is obviously peculiar if the type locality of *elegans* is correct but a later paper by Hallowell raises doubts as Schmidt points out. As our Entebbe specimen agrees with the description of *elegans* I use the name tentatively pending increase in our knowledge of variation within this genus.

Variation. Scale-rows behind head 24, midbody 26, immediately in front of anus 23.

Measurements. Total length 237 (206+31) mm.

CHAMAELEONTIDAE

In 1887, at the time of the publication of Boulenger's third volume of the Catalogue of Lizards in the British Museum, he was able to define three genera of chameleons (p. 438) as follows:—

Claws simple, scales on soles smooth; tail at least as long as the body .... *Chamaeleon*
Claws simple; scales on soles spinose; tail shorter than the body .... *Brookesia*
Claws bicuspid; scales on soles spinose; tail shorter than the body .... *Rhampholeon*

In his redescription of *Chamaeleon anchietae*, however, he states, "Tail slightly longer than head and body." though this contradicts Bocage's measurements of the type series of five specimens. That these were correct is apparent from the plate of *anchietae* which appeared some years later in Bocage's work on the herpetology of the Congo and Angola. In an example of *anchietae* obtained during the present expedition the tail is considerably shorter than the length from snout to anus.

During the interval that has elapsed since 1887 a large number of reptiles variously described as *Brookesia* or *Rhampholeon* have been discovered and it is obvious that the genus *Rhampholeon*, proposed by Günther in 1874, will have to be placed in the synonymy of *Brookesia*, Gray 1864. My reasons for reaching this conclusion are as follows:

In 1893 Matschie described *Chamaeleon* (*Brookesia*) *temporalis* from Derema, at the same time he described *Chamaeleon* (*Brookesia*) *brevicaudatus* from the same type locality. *Both have simple claws* but because *temporalis* had smooth soles Tornier left it in the genus *Chamaeleon* but transferred *brevicaudatus* to *Rhampholeon* because of its very spinose soles. Yet so closely related are the two that I misidentified a *temporalis*, obtained at Amani in 1926, for *brevicaudatus*. This would not have happened had not Werner, following Tornier, left *temporalis* in *Chamaeleon* when he revised the family and despite the excellent figures given by Tornier which show its stumpy tail (*vide.* Tornier, 1897, Die Kriechthiere Deutsch-Ost-Afrikas, pl. ii, figs. 5 & 7).

Angel, in his revision of the Malagasy *Brookesia* in 1929, points out that a number of species have spinose soles but at least three have smooth soles. So that smooth and spinose soled forms occur both among the Malagasy and Continental forms, and though bicuspid claws are found only among Continental reptiles, simple claws occur in both Malagasy and Continental species. If we arbitrarily continue

to define genera on the basis of simple or bicuspid claws it divides closely related species such as *temporalis* and *platyceps* also *brevicaudatus* and *brachyurus* which form parallel groups of simple and bicuspid claws, the former having a rostral process in common, the latter without any such process. The following key will cover the suggested arrangement.

Tail prehensile, usually as long as, or longer than, the body; soles smooth; claws simple . . . . *Chamaeleon*

Tail not prehensile, always shorter than the body; soles smooth or spinose; claws simple or bicuspid . . . *Brookesia*

Chamaeleon gracilis gracilis Hallowell

Chamaeleo gracilis Hallowell, 1842, Journ. Acad. Nat. Sci. Phila., p. 324, pl. xviii: Monrovia, Liberia.

3 (M. C. Z. 31081–2) Entebbe, Uganda. 27. vi. 30.

Measurements. Largest female (No. 31082) measures 282 (147+135) mm. The tails are included 0.48 times in the total length.

Chamaeleon dilepis roperi Boulenger

Chamaeleon roperi Boulenger, 1890, Proc. Zoöl. Soc. London, p. 85, pl. viii, fig. 4: Kilifi, north of Mombasa, Kenya Colony.

♂ ♀ (M. C. Z. 31083–4) Mainland near Mombasa. 29. x. 29.
♂ (M. C. Z. 31085) Changamwe, Kenya Colony. 31. x. 29.

Measurements. Larger male measures 183 (89+94) mm. The tails of the males are included 0.47–to 0.51 times in the total length, that of the female 0.48 times.

Diet. The stomachs of the Kilindini specimens were examined and that of the male found to hold many greenbottle flies, while in the female there was the hind leg of an orthopteran and numerous remains of beetles among which weevils and a buprestid were recognizable.

Habitat. At Kilindini the female was taken as she stalked across some open grassland, the male was in a mimosa bush. Curiously enough I pulled off the larval case of a psychid moth from a branch close beside the chameleon without seeing the reptile so closely did it match its surroundings, it was then pointed out by the native who accompanied me. The Changamwe male was taken as it ascended a tree trunk.

CHAMAELEON DILEPIS QUILENSIS Bocage

Chamaeleo dilepis var. *quilensis* Bocage, 1866, Jorn. Sci. Math. Phys. Nat. Lisboa, **1**, p. 59: Rio Quillo, Angola.

1 (M. C. Z. 31086) Iringa, Uhehe. 30. i. 30.
7 (M. C. Z. 31087–93) Matema, near Mwaya. 28. ii. 30.
50 (M. C. Z. 31094–110) Mwaya, Lake Nyasa. 1–8. iii. 30.
Eggs and 38 (M. C. Z. 31111–35) Ilolo, Rungwe. 15. iii. 30.
4 (M. C. Z. 31136–9) Tukuyu, Rungwe. 13. iii. 30.
4 (M. C. Z. 31140–3) Nyamkolo, Lake Tanganyika. 9. v. 30.
1 (M. C. Z. 31144) Ujiji, Lake Tanganyika. 29. v. 30.
1 (M. C. Z. 31145) Mwanza, Lake Victoria. 6. vi. 30.

Distribution. Also seen at Mwandemeres. This race has already been recorded from Iringa under the name of *C. parvilobus* Blgr. In his 1913 paper on the reptiles of German East Africa, Nieden did not list this form. It is very doubtful if it is a true geographical race.

Native names. Uluwifi (Kinyakusa); *lumvu* (Kirungu).

Variation. The tails of 40 males range from .46 to .53 of the total length, with an average of .49; those of the 57 females are from .44 to .53, also with an average of .49; in 11 young the average is .47.

Coloration. The following striking variations were noted at Ilolo: (i) A very dark green spotted all over with yellow and pale green; on the tail, bands of dark and pale green alternate, lateral stripe absent. (ii) Pale yellow green more or less finely mottled with yellow; a white stripe bordering the buccal opening covers both upper and lower labials, another on the flank but not extending as far as the hind limb; the foot margined with white one scale in width. (iii) ♂. Ashy grey with darker bands on tail and sides spotted with blue-black. (iv) Dark olive with lips and lateral stripe of china-white also a spot of white near the occipital lobe and another on the middle of the side. (v) A specimen which was wrathful or scared. Absolutely black except for the light ventral line and the interstitial gular skin which was orange.

Measurements. The largest male measures 265 (124+141) mm.; the largest female 286 (133+153) mm.; the smallest specimen only 66 (34+32) mm. is from Mwaya.

Breeding. Of 23 females taken at Ilolo, all except the largest, which was presumably sterile, carried well-developed eggs. The numbers in ten females examined ranged from 26 to 41 with an average of 31. Their measurements were as follows:

(1) 25 measuring 8.5 mm. diameter.	(6) 41 measuring 13 x 7.5 mm.
(2) 35 " 9 mm. "	(7) 30 " 14 x 8 mm.
(3) 38 " 9 mm. "	(8) 30 " 14 x 8 mm.
(4) 35 " 12 x 6.5 mm.	(9) 24 " 15 x 7 mm.
(5) 34 " 12 x 7.5 mm.	(10) 25 " 16 x 7 mm.

Diet. The distinguishable contents of the stomachs of these ten females was: (i) Beetles, two snails, (ii) two beetles, three snails, (iii) beetle, two grasshoppers, snail, (iv) beetle, grasshopper, hawkmoth larva, snail, (v) beetles, grasshoppers, (vi) many beetles, many grasshoppers, two greenbottle flies, (vii) several large grasshoppers, (viii) small grasshopper, big green caterpillar, (ix) many small grasshoppers, a butterfly or moth, (x) many greenbottle flies, butterfly, snail.

Chamaeleon dilepis dilepis Leach

Chamaeleo dilepis Leach, 1819, in Bowdich, Miss. Ashantee, App. p. 493: Gaboon.

1 (M. C. Z. 31146) Kilimatinde, Ugogo. 27. xi. 29.
1 (M. C. Z. 31147) Unyanganyi, Turu. 7. xii. 29.
8 (M. C. Z. 31148–55) Mangasini, Usandawi. 12–16. xii. 29.
1 (M. C. Z. 31156) Kikuyu, Ugogo. 23. xii. 29.
4 (M. C. Z. 31157–60) Ukerewe Id., Lake Victoria. 11. vi. 30.

Distribution. Already recorded by Nieden from Kilimatinde and Mwanza.

Native names. *Wambu* (Kinyaturu); *kathlange* (Kisandawi); *luivu* (Chigogo).

Variation. The tails of the 7 males range from 0.45 to 0.52 of the total length, with an average of 0.478; those of the 13 females are from 0.46 to 0.52, with an average of 0.496.

Measurements. The largest male measures 283 (137+146) mm.; the largest female 299 (150+149) mm. Both from Ukerewe Island.

Diet. Stomach contents were as follows:—(1) Full of beetle remains, (2) distended with coccinelids and other beetles, grasshoppers and a large field cockroach, (3) winged termites, and its own cast slough, (4) winged termites, a common striped moth, its own cast slough, (5) termites, large locust, (6) beetles, green elytra of rose beetle, grasshoppers. A seventh chameleon disgorged winged termites and a large grasshopper.

Enemies. One chameleon was recovered from the stomach of a Boomslang (*Dispholidus typus*) at Mangasini.

Habitat. A rather emaciated male, though its stomach was full of

beetle remains, was taken on a manyara hedge at Kilimatinde. As so many creatures shun the poisonous manyara it seems worth recording.

Chamaeleon bitaeniatus bitaeniatus Fischer

Chamaeleo bitaeniatus Fischer, 1884, Jahrb. Hamb. Wiss. Anst., **1**, p. 23, pl. ii, fig. 7: Masailand, East Africa.

59 (M. C. Z. 31161–83) Entebbe, Uganda. 27. vi. 30.
2 (M. C. Z. 31184–5) Mabira Forest, Uganda. 1. vii. 30.

Variation. Only 25 adults were selected for measurement, of these the tails of 11 males range from 0.44 to 0.51 of the total length, with an average of 0.469; those of 14 females are from 0.42 to 0.48, with an average of 0.462.

Measurements. The largest male measures 159 (81+78) mm.; the largest female 157 (81+76) mm.; the smallest example 49 (28+21) mm.

Breeding. Many of the females held embryos.

Chamaeleon bitaeniatus höhnelii Steindachner

Chamaeleon höhnelii Steindachner, 1891, Sitzber. Akad. Wiss. Wien, **100**, p. 309, pl. 1, fig. 2: Leikipia, Kenya Colony.

♂ ♀ (M. C. Z. 31384–5) Kabete, Kenya Colony. 7. vii. 30.

Variation. Both variation and measurements are within the range shown by the 431 specimens in the United States National Museum (Loveridge, 1929, U. S. Nat. Mus. Bull. No. 151, pp. 87–89).

Breeding. The female holds very large ova.

Chamaeleon anchietae Bocage

Chamaeleo anchietae Bocage, 1872, Jorn, Sci. Lisboa, p. 72, fig.: Huilla, Mossamedes, Angola.
Chamaeleon anchietae Boulenger, 1887, Cat. Lizards Brit. Mus., **3**, p. 452.

♀ (M. C. Z. 31186) Panga Mawe, Uzungwe Mtns. 8. i. 30.

Distribution. This constitutes the first record of this scarce species in East Africa, and appears to be the only specimen collected since the type series was described sixty years ago.

Variation. Though he had no specimen Boulenger has added to the original description, "Tail slightly longer than head and body." This

contradicts the measurements given by the author and is opposed to his excellent figure which later appeared in the Herpetology of Angola and the Congo. In my specimen the tail is 0.36 of the total length.

Measurements. Total length 113 (72+41) mm.

Breeding. Ova are small and undeveloped.

Diet. Stomach empty.

Parasites. A nematode (*Strongyluris sp.*) was present in the intestine.

Habitat. My attention was attracted by the very brilliant green coloring of this chameleon which was walking through short, freshly-springing grass on a recently burnt-over hillside. It would seem probable that the short tail indicates a species which has become adapted to life on low shrubby plants on wind-swept mountainsides.

Chamaeleon goetzei Tornier

Chamaeleon goetzei Tornier, 1899, Zoöl. Anz., **22**, p. 413, fig. 3: Uhehe, Tanganyika Territory.

2 (M. C. Z. 31187–8) Dabaga, Uzungwe Mtns. 1. i. 30.
1 (M. C. Z. 31189) Lukungu, Ubena Mtns. 8. ii. 30.
2 (M. C. Z. 31190–1) Ihenye, Ukinga Mtns. 8. ii. 30.
4 (M. C. Z. 31192–5) Mangoto, Ukinga Mtns. 10. ii. 30.
2 (M. C. Z. 31196–7) Tandala, Ukinga Mtns. 11. ii. 30.
3 (M. C. Z. 31198–200) Bulongwa, Ukinga Mtns. 12. ii. 30.
3 (M. C. Z. 31201–3) Madehani, Ukinga Mtns. 14. ii. 30.
60 (M. C. Z. 31204–20) Ilolo, Rungwe district. 15–30. iii. 30.
4 (M. C. Z. 31232–5) Igale, Poroto Mtns. 30. iv. 30.

Distribution. Also seen at Lukowa in the Ubena Mountains. Listed by Nieden in 1913 as occurring in Ubena, Uhehe and at Tukuyu.

Native name. Tanatzi (Kikinga).

Variation. The tails of 42 males range from .47 to .54 of the total length, with an average of .51; those of 32 females are from .50 to .54 with an average of .52.

Coloration in life. ♀ Madehani. Above and sides of head, limbs, flanks and tail, olive brown; vertebral crest rich dark green; four large patches of green on each side, their upper portions interrupting a light buff line which extends from the eye to the base of the tail; a second buff line extends only from the eye to the fore arm and a third buff line from the posterior portion of the upper lip to axillary region being immediately above the concealed black gular streak; a little black, almost as an interrupted continuation of the black gular streak, shows here and there along the lowest part of the flank when the reptile is

alarmed or annoyed. Below the throat is lemon-yellow except for two longitudinal, white streaks which merge into the narrow ventral area.

The first specimen found at Dabaga, when chloroformed, became entirely plumbeus except for the lips which remained white. Three females from Bulongwa were a vivid green in life.

Measurements. The largest of 42 males measures 208 (95+113) mm.; the largest of 32 females is 190 (89+101) mm.; both from Ilolo.

Breeding. Young chameleons of 48 (25+23) mm., 51 (26+25) mm., and 52 (28+24) mm. were taken at Ihenye, Ilolo and Nyamwanga on the dates given above.

Diet. The stomach contents of fifteen chameleons from Ilolo and Nyamwanga were as follows: (i) House fly and many bugs, (ii) beetles, two large ants, three caterpillars, (iii) beetle, large moth, two caterpillars, spider, (iv) tortoise beetle, bug, large dipteron, grasshopper, (v) grasshopper, cockroach, (vi) grasshopper, three caterpillars, (vii) beetle larva, ant, bluebottle, (viii) beetles and many other masticated insects, (ix) beetles, froghopper, (x) beetles, bug, (xi) beetle, bug, (xii) beetles, ants, (xiii) beetles, caterpillar, (xiv) beetles, three caterpillars, grasshopper, (xv) beetles, caterpillar, grasshopper, froghopper, ant, spider.

Parasites. Nematodes (*Strongyluris ? brevicaudata*) were present.

Enemies. Both at Lukowa and Lukungu in the Ubena Mountains I came upon dead and decaying chameleons in the path. Wakinga natives told me that they always killed chameleons "because they spit venom"; a native interpretation of the rapidly projected tongue.

Defence. When taken up the first chameleon hissed and *whistled*, the whistle always appears to follow the hiss and I have never known chameleons of any other species to make this sound. Later I was able to confirm the observation and found that whistling was a common accompaniment of the creature's protestations when seized *the first time* but that it is not repeated after the reptile has been handled, so that it is unlikely to be noticed in specimens which may reach zoölogical gardens. This unique achievement for a chameleon is doubtless connected with the peculiar large black patches concealed in folds on either side of the throat and looking almost exactly like the singing pouches of certain male frogs of the genus *Rana*.

Chamaeleon tempeli Tornier

Chamaeleon tempeli Tornier, 1899, Zoöl. Anz., **20**, p. 411, fig. 2: Utschungwe (i.e. Uzungwe) Mountains in Uhehe, Tanganyika Territory.

Chamaeleon tempeli var. *wolfi* Tornier, 1900, Zoöl. Jahrb. Syst., **13**, p. 614, fig. G (note, the figures are reversed but the error was corrected in separates in Tornier's own hand, also the fig. is labelled *wolffi*, not *wolfi*): Tardalla (i.e. Tandala, Ukinga Mountains, Tanganyika Territory).

22 (M. C. Z. 31236–48) Dabaga, Uzungwe Mtns. 1. i. 30.
2 (M. C. Z. 31249–50) Mufindi East, Uzungwe Mtns. 9. i. 30.
24 (M. C. Z. 31251–60) Kigogo, Uzungwe Mtns. 13. i. 30.
1 (M. C. Z. 31261) Mangoto, Ubena Mtns. 10. ii. 30.
14 (M. C. Z. 31262–5) Tandala, Ukinga Mtns. 11. ii. 30.
1 (M. C. Z. 31266) Bulongwa, Ukinga Mtns. 12. ii. 30.
51 (M. C. Z. 31267–85) Madehani, Ukinga Mtns. 13–28. ii. 30.

Distribution. According to Nieden, in 1913 typical *tempeli* was only known at that time from the Uzungwe Mountains and Ufipa to Lake Tanganyika while of the subspecies *wolfi* only the type was known.

Native names. Lumwilifwi (Kihehe for all chameleons); *tanatzi* (Kikinga, but not specific).

Affinities. C. t. wolfi was described from a single specimen which had the two anterior projecting rostral scales of *C. t. tempeli* fused into a single scale or tiny horn. With the object of finding whether this character was constant I camped at Tandala for one night and secured fourteen topotypes. Of these only two, a ♂ and ♀, have the terminal rostral scales fused in this fashion, the remaining twelve have the normal arrangement of the typical form from the Uzungwe Mountains. At Madehani forty-five are of the *tempeli* type and two of the *wolfi*, three others are somewhat intermediate. The Mangoto and Bulongwa chameleons which should agree with *wolfi* are also of the *tempeli* type. If further proof is required that *wolfi* is anything but a variant it might be remarked that there are five chameleons of the *wolfi* type in the topotypic series of *tempeli* from Kigogo and Dabaga.

Variation. The tails of 31 males range from .49 to .53 of the total length, with an average of .50; those of 24 females have the same range but average .53.

Coloration in life. At Dabaga it was noted that for a chameleon the coloring was most unusual in shades of ochre, buff, olive, reddish-brown, blue grey, black and white. The head of ochre; the points of the spines are tipped with black; there are reddish-brown blotches alternative with blue grey along the spine; the sides are blotched with olive and blue grey, the limbs are tinged with yellow; underparts whitish; the interstitial gular skin black. Another specimen was colored in shades of rotten wood—browns and black. These shades are characteristic of a common shrub (*Protea sp.*) which is abundant at Dabaga.

Of the two taken at Mufindi one showed the dorsal line and spines all black and three black marks on each flank. In the other the top of the head was a pinkish-ochre; just below the dorsal spines was a light lateral streak while the intermediate area was raw sienna; the throat was chalky-white with black interstitial skin.

A young one at Kigogo, taken on green leaves, was distinctly greenish in shade; it is quite usual for one side of these chameleons to be in paler tints than the other. I caught a male in the act of descending a tree trunk the lichen of whose bark he matched to perfection.

Unfortunately no notes were taken of Ukinga specimens but my first impression was that the series from this region differed somewhat in general color, being less ochraceus and more olivaceus than those from the Uzungwe Mountains.

Measurements. The largest male measures 213 (109+104) mm.; the largest female 203 (98+105) mm.

Breeding. Both at Kigogo and Madehani young specimens were collected which measured 61 (31+30) mm.

Diet. The distinguishable contents of the stomachs of Kigogo specimens were: (i) Beetles, caterpillars, flies, spider, (ii) beetles, caterpillars, flies, (iii) beetles, caterpillars, flies, (iv) beetles, flies, spider, (v) beetles, caterpillars, spider, (vi) beetles, two caterpillars, several spiders, (vii) beetles etc. (viii) beetles, flies, (ix) beetles, (x) beetles, (xi) beetles, (xii) caterpillars.

At Mangoto and Madehani the following were recognizable: (i) beetles, caterpillar, (ii) beetles, caterpillar, (iii) beetles, caterpillar, (iv) beetles, caterpillars, (v) beetles, caterpillars, (vi) beetles, caterpillar, grasshoppers, (vii) beetles, caterpillar, spider, (viii) caterpillar, flies, bug, (ix) beetles, (x) flies, grasshoppers.

Parasites. Nematodes (*Strongyluris brevicaudata*) appear to be invariably present in the intestines of this species and were collected at Dabaga, Kigogo, Mangoto, Tandala and Madehani; cestodes (*Oochoristica theileri*) were also found.

Enemies. At Dabaga one was recovered from the stomach of a hawk (*Astur t. sparsimfasciatus*).

Habitat. Most of these chameleons were taken on low bushes or brambles growing in rank grass. Under the circumstances it seems strange that grasshoppers do not figure more prominently as an article of diet, the caterpillars which they prefer are mostly Lycaenid species, the beetles do not include many large kinds but a great variety of small and often brilliantly colored species. It is probable that flies figure less than is really the case for being delicate they are usually masticated beyond recognition.

Chamaeleon fülleborni Tornier

Chamaeleon fülleborni Tornier, 1900, Zoöl. Jahrb. Syst., **13**, p. 614, fig. H: Slope of Ngosi or Poroto Mtns. etc., Tanganyika Territory.

137 (M. C. Z. 31286–335) Nyamwanga, Poroto Mtns. 17. iii. 30.

Distribution. The above series are topotypes for Nyamwanga is the last village on the way up to the Ngosi Volcano in the Poroto Mountains. The species is only known from the type series one of which was said to be from "Nonde Nike" which presumably means Ukonde-Unyika, i.e. the district inhabited by the Wakonde and Wanyika tribes who are settled round about and in the Poroto Range. The third cotype came from Kungura Mountain which is presumably in the same range or vicinity.

Variation. The series consists of 72 males, 59 females and 6 young. The tails of 25 males range from .47 to .54 of the total length, with an average of .51; those of 20 females from .48 to .54 with an average of .51; those of the 6 young average .48. In all the young the tail is from 2 to 3 mm. shorter than the length from snout to vent.

Measurements. The largest male measures 222 (105+117) mm.; the largest female 204 (99+105) mm.

Breeding. In ten females examined the eggs were still spherical varying between 6 and 7 mm. in diameter. The number of eggs developing in these ten chameleons was 11, 11, 12, 14, 15, 15, 16, 18 and 24 which gives an average of 15. The six young, evidently from the last breeding season, range from 70 to 77 mm. in length.

Diet. The stomachs of all ten specimens examined held nothing but beetle remains, chiefly those of a large species of rose beetle and a conspicuous ladybird (coccinellid); it is unusual for chameleons to restrict themselves to one form of diet and it may well be that the time of my visit coincided with the swarming of beetles.

Chamaeleon werneri werneri Tornier

Chamaeleon werneri Tornier, 1899, Zoöl. Anz., **22**, p. 258, fig. 1 (of a horned ♀): "Maschona-Gebiet, Deutsch-Ost-Afrika" (presumably the Wamashonde district, Tanganyika Territory); Nieden, 1913, Mitt. Zoöl. Mus. Berlin, **5**, p. 98: Rufigi, Uhehe, Ufipa and Usagara.

2 (M. C. Z. 31336–7) Mufindi East, Uzungwe Mtns. 9. i. 30.
8 (M. C. Z. 31338–43) Kigogo, Uzungwe Mtns. 13–30. i. 30.

Distribution. When Goetze collected the type which was a one-horned female, the region had but recently been brought into subjection to German rule and I am not certain whether the Uzungwe

Mountains formed part of the Wamashonde district, or whether the type locality should be looked for in the mountainous country just south of the Uzungwe. Possibly the type female came from the Uzungwe for a few months later Tornier figured the three-horned male collected by Goetze in the Uzungwe range which is generally regarded as the type locality of the form.

Variation. The tails of the 5 males range from .49 to .53 of the total length, with an average of .51, those of the 5 females are from .48 to .51 with an average of .49.

Coloration in life. ♂ Mufindi. A very richly colored chameleon but the species changes color much more rapidly than most members of the genus. The horns are Indian-red; there are four dark saddle-like markings on the back, the intermediate areas being buff; the sides are rich green mottled with black and a little white, the interstitial skin is a deep crimson-lake which shows in streaks as the animal inflates. The greens are reminiscent of shades of lichen but the effect of all the coloring is to give a velvety appearance to the chameleon.

♀ Mufindi. Above green bice, darker on the back, the interstitial gular skin Indian-red. When annoyed this reptile changes from dark olive to muddy-black while several darker streaks appear on the occipital flaps and three rather indistinct vertical bars upon the sides of the body.

Measurements. The largest male measures 201 (103+98) mm., the largest female 203 (100+103) mm.

Breeding. The ova in all five females is undeveloped.

Diet. The distinguishable contents of the stomachs was as follows: (i) Beetles; caterpillar; grasshopper, (ii) beetles; four caterpillars, (iii) many beetles, chiefly weevils; seven caterpillars, mostly Lycaenid; a few flying ants; large flies; muscid fly; one froghopper, (iv) beetles; caterpillar; froghopper, (v) beetles, including golden beetle; flies, including a greenbottle; other insects, (vi) beetles; a wasp; a small polydesmid.

Parasites. Nematodes (*Strongyluris brevicaudata*) invariably present in the intestine but not in the stomach.

Enemies. The horn of one of these chameleons was recovered from the stomach of a Mountain Buzzard (*Buteo oreophilus*) shot at Kigogo.

Chamaeleon werneri dabagae Loveridge

Plate 3, fig. 5

Chamaeleon werneri dabagae Loveridge, 1932, Bull. Mus. Comp. Zoöl., **72**, p. 379: Dabaga, Uzungwe Mountains, Tanganyika Territory.

5 (M. C. Z. 31344–8) Dabaga, Uzungwe Mtns. 1. i. 30.

Variation. The tails of the 3 males range from .50 to .53 of the total length; those of the 2 females are .51.

Parasites. Nematodes (*Strongyluris brevicaudata*) were present in the intestines.

Chamaeleon jacksoni vauerescecae Tornier

Chamaeleon jacksoni var. *vauerescecae* Tornier, 1903, Zoöl. Jahrb. Syst., p. 176: Nairobi, Kenya Colony.

2 (M. C. Z. 31365–6) Nairobi, Kenya Colony. 5. vii. 30.

Variation. The tails of these 2 females are .50 and .53 of the total length.

Measurements. The larger measures 208 (104+104) mm.

Chamaeleon incornutus Loveridge

Plate 3, fig. 4

Chamaeleon incornutus Loveridge, 1932, Bull. Mus. Comp. Zoöl., **72**, p. 380: Madehani, Ukinga Mountains, southwestern Tanganyika Territory.

12 (M. C. Z. 31350–5) Madehani, Ukinga Mtns. 14–28. ii. 30.
4 (M. C. Z. 31356–9) Nyamwanga, Poroto Mtns. 17. iii. 30.
5 (M. C. Z. 31360–4) Nkuka Forest, Rungwe Mtn. 19–30. iii. 30.

The diagnosis of this species has been published already, a more detailed description follows.

Description. Prefrontal region between the canthi rostrali flat and covered with large tile-like plates; canthi rostrali sharp, furnished with knob-like scales over the supraocular region to the occipital flaps; the latter also covered with smooth tile-like plates; around the upper part of the eyelid are long soft spines which are very conspicuous in life but apt to become flattened in preserved specimens; sides and upper surface of limbs covered with conical granular scales, enlarged ones are scattered among the smaller on the flanks but there are so many enlarged on the forearm as to present the appearance of armor-plating; the lower (inner) surface of the limbs is covered with fine granules.

Variation. The tails of the 10 males range from .45 to .50 of the total length, with an average of .48; those of the 10 females are from .48 to .51 with an average of .48.

Coloration in life. Paratype ♂. Nkuka Forest. Above, crown of head

light red as also a broad vertebral band to the end of the body; on either flank a narrow straight band extends from the occipital lobes to the end of the body; rest of body rich sap-green except for a narrow line from the throat to the end of the tail along the median line of the belly which is, like the inner sides of the limbs, a dirty white.

Measurements. Type ♂. Snout to anus 84 mm. Length of tail 77 mm.

The largest male measures 186 (93+93) mm.; the largest female 188 (93+95) mm.

Breeding. All the Madehani and Nyamwanga females hold eggs 6 mm. in diameter and varying in number from 11 to 16 (3 only counted); two females from the Nkuka Forest would appear to have been taken during oviposition for each has only three eggs *in the oviduct,* these eggs measure 7 mm. A young chameleon taken in the Nkuka Forest measures 77 (41+36) mm.

Diet. The distinguishable contents of ten stomachs examined was: (i) Beetles, including two large cetonids, a coccinellid and a tortoise beetle; also a caterpillar, (ii) a hairy and a smooth caterpillar, (iii) wings of dipteron; two hairy and one smooth caterpillar, (iv) cockroach, (v) beetles; fly; attid spider; snail, (vi) beetle; caterpillar, (vii) beetle; homopteron; spider, (viii) beetle; homopteron.

Parasites. Nematodes (*Strongyluris brevicaudata*) were collected from the intestines.

Habitat. I caught the type as it was descending the lichen-covered trunk of a tree a hundred yards from the forest-edge. Recognizing it as a species new to the Territory it was shown to the natives and a special reward of ten cents (2 cents in U. S. currency) offered. Undoubtedly it is a scarce forest-glade form as only four of over one hundred and fifty chameleons brought in at Nyamwanga were of this species.

Chamaeleon laterispinis Loveridge

Plate 3, fig. 3

Chamaeleon laterispinis Loveridge, 1932, Bull. Mus. Comp. Zoöl., **72**, p. 381: Kigogo, near Mufindi, Uzungwe Mtns., Tanganyika Territory.

3 (M. C. Z. 31386–8) Kigogo, Uzungwe Mtns. 18–23. i. 30.

The diagnosis of this species has been published already, a more detailed description follows. All three types are males.

Description. Casque moderate, rather low, no rostral or other processes; canthi rostrali terminating in two scales; a rather indistinct parietal crest forking anteriorly; occipital flaps movable but somewhat

rudimentary, covered by large flat as well as knob-like plates; a prominent thorn-like scale in the temporal region and others on the eyelid above the eye; a beard-like appearance is produced on the throat by reason of the many long scales anteriorly and on the sides. Vertebral line with a series of 17 large, soft spikes, each equidistant from its fellow, separated by an interspace on the base of the tail from another, but smaller and gradually dwindling, series on the tail; sides covered with large, flat, or rounded plates which are separated from one another by smaller granular scales; on either side of the body are two (or three) groups of soft, thorn-like spines, each group composed of 2 (occasionally 1 or 3) rather flattened scales about 2 mm. in length; a further series of these thorn-like spines on either side of the tail and many others scattered over the limbs. Below, the hinder end of the throat, median line of the belly and underside of the tail are small granules.

Coloration in life. Paratype ♂. Above, pale green, excepting for the dorsal area and top of head which is a pinkish-brown with black saddle markings; the paired "thorns" pinkish-brown but changing to white while the black hour-glass-like markings mentioned in the type become deep green. The effect of this coloration is to produce a very lichen-like appearance.

The type ♂ changed from the description given, as follows. The greenish-white became quite green, the black markings became speckled with brown and a good deal of reddish-brown appeared, chiefly along the vertebral line and on the tail.

Diet. Numerous small beetles, heads of flies, a termite and three caterpillars were found in the stomach of one of these chameleons.

Parasites. The intestine was full of nematodes (*Strongyluris brevicaudata*) but there were none visible in the stomach.

Habitat. All three specimens were taken by Salimu or myself close to our camp above the forester's house where they are to be found on the small shrubs at the edges of the little patches of forest. As only three were secured during the three weeks spent at Kigogo it appears highly probable that the species is rare, at least in this locality.

Brookesia temporalis (Matschie)

Chamaeleon (*Brookesia*) *temporalis* Matschie, 1892, Sitz. Ges. Naturf. freunde Berlin, p. 108: Derema, Usambara Mtns., Tanganyika Territory.

Chamaeleon temporalis Tornier, 1897, Kriechthiere Deutsch-Ost-Afrikas. p. 62, pl. ii. fig. 5; Werner, 1902, Zoöl. Jahrb. Syst., **15**, p. 393; Werner, 1911, Das Tierrich. Chamaeleontidae, p. 23.

1 (M. C. Z. 24385) Amani, Usambara Mtns. 24. xi. 26.

Affinities. As already stated in the discussion on the generic status of *Rhampholeon* under the heading of Chamaeleonidae this interesting little species has long been lost sight of owing to Tornier's mistaken action in referring it to the genus *Chamaeleon.*

In connection with the identification of the specimens of *platyceps* next following, it occurred to me to reëxamine M. C. Z. 24385 which was obtained at Amani, only three miles distant from Derema, and which in 1928 had been referred to *brevicaudatus* with a long series of that species. I found that it agreed in every detail with Matschie's description of *temporalis* including the simple claws, and smooth scales on the soles of its feet.

BROOKESIA PLATYCEPS (Günther)

Rhampholeon platyceps Günther, 1892, Proc. Zoöl. Soc. London, p. 556, pl. xxxiv, fig. 1: Shiré Highlands, Nyasaland.

2 (M. C. Z. 31367–8) Tandala, Ukinga Mtns. 11. ii. 30.
1 (M. C. Z. 31369) Madehani, Ukinga Mtns. 13. ii. 30.
3 (M. C. Z. 31370–2) Nyamwanga, Poroto Mtns. 17. iii. 30.
4 (M. C. Z. 31373–6) Ngosi Volcano, Poroto Mtns. 19. iii. 30.
21 (M. C. Z. 31377–83) Nkuka Forest, Rungwe Mtn. iv. 30.

Distribution. B. platyceps is only known from the type from the Shiré Highlands and a male from Nyasaland; the finding of the same species in the Ukinga and Poroto Mountains to the north and northwest of the lake is quite in accord with the occurrence of mammals, birds, and some reptiles such as *Lygodactylus angularis* in the same mountains.

Native names. Wingiruli (Kikinga); *haniula* (Kisufi); *katumbasagesi* (Kinyakusa).

Affinities. B. platyceps forms one of a group (which includes *marshalli* of Chirinda Forest, S. Rhodesia and *boulengeri* from northwest of Lake Tanganyika) characterized by a small scaly flexible, rostral process, bicuspid claws and tubercular soles but no digital spine.

One of the series was submitted to Mr. H. W. Parker for favor of comparison with the type of *Rhampholeon platyceps.* He writes: "As regards the Rhampholeon compared with the type of *platyceps,* your reptile has a more pronounced nasal appendage, larger supraciliary horns, rather flatter head and the upper head scales flatter. Another specimen, a male from Nyasaland, has a longer nasal appendage than yours, but the supraciliary horns are about the same size. Head scales

are as in the type. In default of any other comparative material I should be inclined to regard them as conspecific or at most racially distinct."

Variation. The tails of the 13 males are from 0.21 to 0.27 of the total length, with an average of 0.24; those of the 18 females 0.20 to 0.24 with an average of 0.21.

Coloration. A Tandala female was wood-brown while the Madehani female was sap-green with brownish areas, chiefly the limbs and head. Young from Nyamwanga were cream-colored or bamboo-white. Of those from Ngosi Volcano it was noted that all had the circular eyelids spotted with bright, yet pale, blue.

Measurements. The largest male measures 53 (41+12) mm.; the largest female 76 (60+16) mm., adults of the latter are always much larger than those of the former. The smallest specimen measured 42 (31+11) mm.

Breeding. Ova small but developing at Madehani on February 13th; of the Ngosi series one held 12 eggs measuring 3 mm. in diameter, another 11 eggs of 4 mm., and a third 9 eggs of 5 mm. on March 19th. Of two females brought into camp at Rungwe on April 5th the smaller (55 mm. in total length) held numerous ova 2 mm. in diameter, the larger (70 mm.) held a single very big egg measuring 12 x 7 mm. with what is apparently the commencement of an embryo in it. I concluded that she had probably been taken by a native when in the act of laying, but this is supposition.

Diet. In the stomachs examined the following were found:— (1) Caterpillar and many termites, (2) beetle and grasshopper, (3) beetle, grasshopper, spider, (4) very small grasshoppers and spider, (5) caterpillar, beetle, bug, (6) several spiders.

Parasites. Some cestodes recovered from two chameleons taken on Ngosi Volcano have been identified by Baer as *Nematotaenia jagerskiöldi* Janicki. Unfortunately in reporting upon them, that author (1933, Revue Suisse Zoöl., **40**, p. 79) followed my field label in giving the host as *Rhampholeon brevicaudatus* (Matschie). Matters are further confused by his giving the locality as "Rhodesie meridionale," the material passed through other hands before reaching Dr. Baer and the label may have been copied erroneously.

PT. II. *Amphibia*

MATERIAL

The period of collecting was from October 27, 1929 to July 9, 1930 during which time 2,759 amphibians representing 60 species were preserved. This total comprised 2 species of caecilians, 6 of toads and 52 kinds of frogs; of these 20 were new to the collection of the Museum of Comparative Zoölogy.

This amphibian collection is somewhat disappointing, the subtropical rain forest and rain-swept plateau of the southwestern highlands is much poorer in number of species than the more tropical mountains to the north. Still I was successful in getting topotypic series of nine species which were desired. Mention might be made also of the following rarities: *Scolecomorphus kirkii*, *Rana floweri*, *Hyperolius rhodoscelis*, *Arthroleptis reichei*, *A. schubotzi* and *A. moorei*.

SUMMARY OF TAXONOMIC ALTERATIONS

The following species or races from this collection have been described briefly[1]; additional information regarding them will be found in the present paper; another is described beyond.

Boulengerula changamwensis	Changamwe, near Mombasa, Kenya.
Bufo urunguensis	Kitungulu, Urungu, Tanganyika.
Bufo parkeri	Mangasini, Usandawi, Tanganyika.
Bufo taitanus uzunguensis	Uzungwe, Ubena and Paroto Mtns.
Rana mascareniensis uzungwensis	Dabaga, Usungwe Mtns., Tanganyika.
Arthroleptis rungwensis	Ilolo, Rungwe district, Tanganyika.
Arthroleptis ukingensis	Madehani, Ukinga Mtns., Tanganyika.
Probreviceps macrodactylus rungwensis	Rungwe Mtn., Tanganyika.
Hyperolius parkeri sp. nov.	Dar es Salaam, Derema, Bagamoyo.

In addition to the new species, the following are recorded from Tanganyika Territory for the first time:

Scolecomorphus kirkii Boulenger. Type locality doubtful. ? Nyasaland.
Rana floweri Boulenger of the Sudan and Mozambique.
Rana ansorgii Boulenger of Angola.
Phrynobatrachus perpalmatus Boulenger of the Belgian Congo.
Hyperolius marginatus Peters of Mozambique, also recorded by Ahl in 1931.

Loveridge, 1932, Bull. Mus. Comp. Zoöl., 72, pp. 375-387.
Loveridge, 1932, Occ. Papers Boston Soc. Nat. Hist., 8, pp. 43–54.

while the undermentioned are revived and should be added:

Xenopus victorianus Ahl as *Xenopus laevis victorianus* Ahl.
Arthroleptis whytii Boulenger from the synonymy of *A. stenodactylus* Pfeffer.
Hemisus guineensis Cope as *Hemisus marmoratus guineensis* Cope.

The following are considered strict synonyms:

**Rana barbouri* Loveridge	= *Rana floweri* Boulenger
**Abrana cotti* Parker	= *Rana* (*Abrana*) *floweri* Boulenger
Rana theileri Mocquard	= *Rana oxyrhynchus* Smith
**Rana fülleborni* Nieden	= *Rana fasciata merumontana* Lönnberg
Phrynobatrachus p. werneri Ahl	= *Phrynobatrachus perpalmatus* Boulenger
Chiromantis pygmaeus Ahl	= *Chiromantis petersii petersii* Boulenger
**Chiromantis pictus* Ahl	= *Chiromantis petersii petersii* Boulenger
Chiromantis rugosus Ahl	= *Chiromantis petersii petersii* Boulenger
Hylambates brevipalmatus Ahl	= *Leptopelis bocagii* (Günther)
**Leptopelis barbouri* Ahl	= *Leptopelis aubryi* (A. Duméril)
**Leptopelis tanganus* Ahl	= *Leptopelis uluguruensis* Barbour & Loveridge
**Leptopelis signifer* Ahl	= *Leptopelis vermiculatus* (Boulenger)
Megalixalus dorsimaculatus Ahl	= *Megalixalus fornasinii* (Bianconi)
Hyperolius pygmaeus Ahl	= *Megalixalus fornasinii* (Bianconi)
?*Hyperolius multifasciatus* Ahl	= *Megalixalus brachynemis* Boulenger
?*Hyperolius acuticeps* Ahl	= *Megalixalus brachynemis* Boulenger
Hyperolius ipianae Ahl	= *Megalixalus brachynemis* Boulenger
Hyperolius unicolor Ahl	= *Megalixalus brachynemis* Boulenger
?*Hyperolius asper* Ahl	= *Hyperolius symetricus* Mocquard
**Hyperolius ferniquei* Mocquard	= *Hyperolius striolatus* Peters
Hyperolius coeruleopunctatus Ahl	= *Hyperolius striolatus* Peters
Hyperolius udjidjiensis Ahl (part)	= *Hyperolius striolatus* Peters
Hyperolius substriatus Ahl	= *Hyperolius puncticulatus* (Pfeffer)
Hyperolius callichromus Ahl (part)	= *Hyperolius puncticulatus* (Pfeffer)
**Hyperolius pictus* Ahl (part)	= *Hyperolius marginatus* Peters
**Hyperolius ngoriensis* Ahl	= *Hyperolius marginatus* Peters
**Hyperolius fuelleborni* Ahl	= *Hyperolius mariae* Barbour & Loveridge

It is with real regret that the necessity is forced upon me of relegating to the synonymy more than a score of species very recently described by Dr. Ernst Ahl. Either this author's concept of a species is at variance with that held by most herpetologists or it would appear that he has resorted to a "mass production" method of speciation by describing all material which was not readily identifiable. Such a method tends to throw herpetology into chaos and transfers to others the burden of discovering the true taxonomic status of the forms de-

*Type or topotype examined.

scribed. As an example of what I mean by mass production I would cite a recent paper by Dr. Ahl (1931, Mitt. Zoöl. Mus. Berlin, **17**, pp. 1–132) in which he describes as new ninety-eight "species" of the genus Hyperolius or considerably more than all authors combined have described during all time. In his eagerness for description he does not hesitate to describe frogs "Ohne genauen Fundort" or with "Africa" only designated as the type locality. Little effort appears to have been expended on the correct spellings of place names and this has resulted in names like *Hyperolius ngoriensis* given to the juvenile frog of his *H. pictus* both being attributed to "Krater des Ngori-See's," really the Crater Lake of Ngosi Volcano. Designations which have been obsolete for many years, have been employed for larger areas, thus Abyssinia is used instead of Ethiopia; British-Ostafrika for Kenya Colony; Deutsch-Ostafrika for Tanganyika Territory as well as for Belgian Ruanda-Urundi; Portuguese Ost-Afrika for Mozambique; these are just a few of the changes which have been ignored in the compilation of Amphibia Anura iii in Das Tierrich, 1931, **55**.

In addition to the species synonymized above, a number of corrected records will be found in the bibliography of certain species.

Spawn or tadpoles were collected of *Xenopus laevis victorianus*, *X. muelleri*, *Rana fuscigula angolensis*, *Rana galamensis*, *Arthroleptis parvulus*, *Chiromantis petersii petersii*, *Hyperolius marginatus*, *H. parkeri*, *Hemisus m. marmoratum* and breeding conditions of other species are noted.

ACKNOWLEDGEMENTS

Once again I wish to thank Mr. H. W. Parker for comparing various specimens with the types in the British Museum collection, his comments are included in the text. Also I am indebted to Mons. Angel for affording me the opportunity to examine certain old types of the genus Hyperolius of whose identity I was in doubt. The resultant observations are published in this paper though the species may not have been collected during the course of the expedition.

*List of Species Collected**

Order Apoda PAGE
Family CAECILIIDAE 350
Scolecomorphus kirkii Boulenger 350
Boulengerula changamwensis Loveridge 351

*An asterisk opposite a species indicates that examples are available for exchange. Species in parentheses are discussed though not collected.

Order Salientia PAGE
Family PIPIDAE 351
*Xenopus laevis victorianus Ahl 351
*Xenopus poweri Hewitt 352
*Xenopus muelleri Peters 353

Family BUFONIDAE 354
*Bufo regularis regularis Reuss 354
Bufo carens Smith 355
Bufo urunguensis Loveridge 356
*Bufo parkeri Loveridge 356
Bufo taitanus uzunguensis Loveridge 357
*Nectophrynoides vivipara (Tornier) 357

Family RANIDAE 359
*Rana adspersa (Duméril & Bibron) 359
*Rana delalandii (Duméril & Bibron) 359
*Rana occipitalis Günther 361
Rana fuscigula chapini Noble 361
Rana fuscigula angolensis Bocage 362
Rana galamensis Duméril & Bibron 365
*Rana floweri Boulenger 367
*Rana oxyrhynchus Smith 368
*Rana mascareniensis mascareniensis Duméril & Bibron 369
*Rana mascareniensis uzungwensis Loveridge 370
Rana mascareniensis venusta Werner 370
*Rana ansorgii Boulenger 371
*Rana fasciata merumontana Lönnberg 372
*Phrynobatrachus natalensis (Smith) 373
*Phrynobatrachus acridoides (Cope) 374
Phrynobatrachus perpalmatus Boulenger 375
*Arthroleptis stenodactylus stenodactylus Pfeffer 376
*Arthroleptis whytii Boulenger 378
*Arthroleptis adolfi-friederici Nieden 379
*Arthroleptis reichei Nieden 379
*Arthroleptis schubotzi Nieden 380
*Arthroleptis xenodactylus Boulenger 382
*Arthroleptis moorii Boulenger 383
*Arthroleptis minutus Boulenger 384
Arthroleptis ukingensis Loveridge 385

*An asterisk opposite a species indicates that examples are available for exchange. Species in parentheses are discussed though not collected.

PAGE

Arthroleptis rungwensis Loveridge 386
**Arthroleptis parvulus* Boulenger 386
**Hemisus marmoratum marmoratum* (Peters) 388
Hemisus marmoratum guineensis Cope 389

Family POLYPEDATIDAE 390
**Chiromantis petersii petersii* Boulenger 390
Leptopelis bocagii (Günther) 393
Leptopelis johnstoni (Boulenger) 394
Leptopelis vermiculatus (Boulenger) 395
(*Leptopelis aubryi* (A. Duméril)) 396
(*Leptopelis uluguruensis* Barbour & Loveridge) 397
**Megalixalus fornasinii* (Bianconi) 397
**Megalixalus brachycnemis* Boulenger 399
Hyperolius ? sansibaricus (Pfeffer) 399
(*Hyperolius viridiflavus* (Duméril & Bibron)) 400
(*Hyperolius symetricus* (Mocquard)) 400
(*Hyperolius striolatus* Peters) 401
**Hyperolius callichromus* Ahl 403
**Hyperolius rhodoscelis* (Boulenger) 404
Hyperolius picturatus Peters 405
**Hyperolius puncticulatus* (Pfeffer) 406
**Hyperolius marginatus* Peters 406
**Hyperolius mariae* Barbour & Loveridge 409
Hyperolius ? platyrhinus (Procter) 409
Hyperolius granulatus (Boulenger) 410
**Hyperolius parkeri* sp. nov 410
**Kassina senegalensis* (Duméril & Bibron) 412

Family BREVICIPITIDAE 413
**Breviceps mossambicus* Peters 413
Probreviceps macrodactylus rungwensis Loveridge 414
(*Hoplophryne uluguruensis* Barbour & Loveridge) 414
**Phrynomerus bifasciatus* (Smith) 415

*An asterisk opposite a species indicates that examples are available for exchange. Species in parentheses are discussed though not collected.

Systematic List of Species Collected

CAECILIIDAE

SCOLECOMORPHUS KIRKII Boulenger

Scolecomorphus kirkii Boulenger, 1883, Ann. Mag. Nat. Hist. (5), **11**, p. 48: "Probably vicinity of Lake Tanganyika."

1 (M. C. Z. 16305) Mufindi-Njombe Road, Ubena. 6. ii. 30.

Distribution. Though the type locality of the species was uncertain Boulenger subsequently recorded several examples from Nyasaland; I anticipated finding it in southwestern Tanganyika Territory (*vide.* Loveridge, 1930, Proc. Zoöl. Soc. London, p. 10, footnote and key to species).

Native names. Timagwini (Kibena); *mclawuletzi* (Kikinga).

Variation. This specimen has 152 annular rings (or 157 if some incomplete and indistinct ones are reckoned) as had the type according to Boulenger (though in its present somewhat softened condition I counted 149). There are now eight examples in the British Museum from Zomba and the Shiré Highlands and these range from 134–149, only one Zomba specimen is as low as 134, the series otherwise being 142–149, the range may be regarded as 134–152.

Coloration in life. Above olive; below pinkish-white. After a year in formalin and alcohol it is blue grey above and flesh-colored below, i.e. exactly like *S. uluguruensis* preserved by the same methods. Boulenger described the alcoholic type as, "Dark olive above, brownish olive beneath."

Measurements. When freshly killed the length was 342 mm., the diameter 10 mm., the latter being contained in the former 34.2 times; as now preserved the length is 326 mm. and the diameter 9 mm., the latter being contained in the former 35 times. The type was 38.5 times according to Boulenger, 35 times at the present day; the range of the British Museum series is from 30 to 41 times with a young 182 mm. specimen of 51.1 times. The range for the species is therefore 30 to 51.5 times.

Habitat. When proceeding from Mufindi to Njombe our lorry became stuck several times in the black cotton soil. When about sixty miles out from Mufindi this occurred again; in digging out the back wheels one of my boys unearthed this fine caecilian. The surrounding country was more or less open grassland plateau with scattered orchard forest of small trees.

Boulengerula changamwensis Loveridge

Boulengerula changamwensis Loveridge, 1932, Bull. Mus. Comp. Zoöl., **72**, p. 381: Changamwe, near Mombasa, Kenya Colony.

4 (M. C. Z. 16301–4) Changamwe, K. C. 31. x. 29.

Habitat. The environment in which these caecilians were found is totally different from that of *B. uluguruensis*, the altitude of Changamwe station is only 191 feet. I was engaged in turning over a heap of weeds beneath a mango tree when I caught sight of the first caecilian. The soil below was black earth with a liberal admixture of sand; round about the soil was composed almost entirely of sand. Earthworms were abundant enough under the mango trees but an hour of strenuous digging in the vicinity only resulted in securing three more caecilians.

PIPIDAE

Xenopus laevis victorianus Ahl

Xenopus victorianus Ahl, 1924, Zoöl. Anz. Leipzig, **60**, p. 270: Bussisi, i.e. Busisi, Lake Victoria, Tanganyika Territory.
Xenopus laevis Loveridge (part), 1925, Proc. Zoöl. Soc. London, p. 766.

1 (M. C. Z. 16329) Mwanza, Lake Victoria. 6. vi. 30.
Tadpole and 9 (M. C. Z. 16320–8) Kampala, Uganda. vi. 30.

The Mwanza frog, collected just across the gulf from Busisi, may be considered almost topotypic of Ahl's *victorianus*, a species which in 1925 (*loc. cit.*) I assumed to be a strict synonym of *laevis*. The reasons given for the opinion then expressed are still valid, that is to say, the structural characters on which its author differentiated his holotype from *laevis* are all variable and the variations common to *laevis*. With more material, however, I now find that on size, average color of adults, and shape of claws, *victorianus* may be recognized as a race of *laevis* so I retract the view held in 1925.

The relations of the East African members of the short-tentacled *laevis* group may be summarized as follows:

Habit pyriform, the greatest width of the head being included from one and a third to once and two-thirds times in the greatest width of the body.
  Size large (103 mm. maximum for 33 specimens); black claws flattened when viewed

from above; belly usually immaculate, rarely flecked or vermiculated with grey or brown . . . . *X. l. laevis*

Size moderate (65 mm. maximum for 14 specimens); black claws narrow, relatively slender when viewed from above; belly usually flecked or spotted with grey or black, immaculate in young . . . . *X. l. victorianus*

Size moderate (65 mm. maximum for 10 specimens); black claws narrow, rounded when viewed from above; belly always heavily vermiculated or blotched with black . . . . *X. poweri*

Habit slender, sides parallel, the greatest width of the head being equal to, or only a trifle larger, than the greatest width of the body.

Size small (53 mm. maximum for 173 specimens); black claws narrow, relatively slender when viewed from above; belly usually, thighs below almost always (2% are not), flecked and spotted with black. Breeds at 35 mm . . . . *X. l. bunyoniensis*

Xenopus poweri Hewitt

Xenopus poweri Hewitt, 1927, Records Albany Mus., **3**, p. 413; pl. xxiv, fig. 3: Victoria Falls, Northern Rhodesia.

10 (M. C. Z. 16312–9) Tukuyu, Rungwe. 13. iii. 30.

Affinities. The above series were submitted to Mr. J. Hewitt for favor of comparison with the type and only known specimen of *poweri* with which all agree in the heavy vermiculation of the lower surface. The two largest frogs measure 65 mm., the same as the type of *poweri*.

Mr. Hewitt writes: "Yours is certainly near to my *poweri:* the latter, known only from the type specimen, unfortunately, has a trifle longer eye tubercle, otherwise I would say is the same species as yours. I reject them as *laevis*. If you compare their claws with those of *laevis* you will have no difficulty in distinguishing them. The claws of your specimens when unworn are long and slender, something like those of *muelleri*. Our specimens have flatter claws. Our *laevis* also grows bigger, never has well defined spots on the belly and I fancy the

metatarsal tubercle is stronger. Thus *poweri* cannot go in *laevis* nor in *muelleri* but I have sometimes considered if it can be a hybrid: your series has restored my confidence in it as a distinct entity. I have not investigated skeletal characters in your material but you will notice from my account of *poweri* that the foot seems to be promising as a means of discrimination." Later he wrote agreeing that "the metatarsal tubercle prominence is variable in appearance according to the preservation."

I take this opportunity of expressing my thanks to Mr. Hewitt for these very helpful observations. Finding considerable variability in eye tentacle length in other species, however, I do not feel justified in describing this Tukuyu form as distinct from *poweri* on such slender grounds. Moreover Tukuyu is less than eight hundred miles from the Victoria Falls and they are connected except for a hundred miles by the Luangwa and Zambesi, the former being a tributary of the latter.

After checking with the material in the Museum of Comparative Zoölogy, I have embodied Mr. Hewitt's views on the distinguishing characters of these frogs as opposed to *laevis* in the key on the preceding page. It might be added that the measurements given for *X. l. laevis* are based on Kenya specimens for undoubtedly true *laevis* occurs on the upland plateau of that colony while *X. l. victorianus* not only occurs round the shores of Lake Victoria but also adjacent to the rain-forest outlyers of the Usambara and Uluguru Mountains.

Xenopus muelleri (Peters)

Dactylethra muelleri Peters, 1844, Monatsb. Akad. Wiss. Berlin, p. 37: Mozambique.

6 (M. C. Z. 16306–8) Handa, Usandawi. 10. xii. 29.
1 (M. C. Z. 16309) Sumbwa, Lake Tanganyika. 20. v. 30.
Tadpoles (M. C. Z. 16310) Albertville, Lake Tanganyika. 21. v. 30.
1 (M. C. Z. 16311) Shinyanga, Usukuma. 4. vi. 30.

Coloration. All are spotted on the ventral surface.

Breeding. The identification of the big series of tadpoles can be regarded as tentative until adult frogs are collected at Albertville. These curious tadpoles were swimming about in a swamp close to the lake shore. Below them and quite motionless with claws extended lay a *Bellostoma* apparently awaiting the near approach of an unwary pollywog. Young numerous at Handa.

Habitat. The Handa frogs were taken from waterholes in a valley in very arid country. Only one adult was found, scores of young were

netted and released. The Sumbwa specimen was in a small pool close to the lake. The Shinyanga frog in a pool in the river bed, the whole region being very dry at the time of my visit.

BUFONIDAE

Bufo regularis regularis Reuss

Bufo regularis Reuss, 1834, Mus. Senckenberg, **1**, p. 60: Egypt.

1 (M. C. Z. 16351) Miritini, K. C. 30. x. 29.
1 (M. C. Z. 17079) Bagamoyo, T. T. 11. xi. 29.
2 (M. C. Z. 16352) Mpwapwa, Ugogo. 23. xi. 29.
4 (M. C. Z. 16353–4) Mangasini, Usandawi. 14. xii. 29.
1 (M. C. Z. 16355) Dabaga, Uzungwe Mtns. 1. i. 30.
1 (M. C. Z. 16356) Mwaya, Lake Nyasa. 1. iii. 30.
4 (M. C. Z. 16357–8) Ilolo, Rungwe. 15. iii. 30.
1 (M. C. Z. 16359) Nkuka Forest, Rungwe Mtn. iii. 30.
1 (M. C. Z. 16360) Igale, Poroto Mtns. 30. iv. 30.
1 (M. C. Z. 16361) Nr. Ikombo, N. Rhodesia. 6. v. 30.
6 (M. C. Z. 16362) Nyamkolo, Lake Tanganyika. 9. v. 30.
1 (M. C. Z. 16363) Kitungulu, Urungu. 15. v. 30.
2 (M. C. Z. 16364–5) Albertville, Lake Tanganyika. 21. v. 30.
1 (M. C. Z. 16366) Ujiji, Lake Tanganyika. 28. v. 30.
15 (M. C. Z. 16367–71) Entebbe, Lake Victoria. 27. vi. 30.
2 (M. C. Z. 16372–3) Kampala, Uganda. vi. 30.
1 (M. C. Z. 16374) Jinja, Uganda. 30. vi. 30.
1 (M. C. Z. 16375) Mabira Forest, Uganda. 1. vii. 30.

Distribution. Also seen on the mainland opposite Kilindini harbour, and at Tanga, Mwandemeres and Tukuyu at which places toads were caught, examined and released. Noted as abundant in most of the localities except in the Uzungwe, Rungwe and Poroto Mountains.

Native name. Ikiyula (Kinyakusa).

Variation. There is the usual wide range of variability, the Igale toad was very warty and presented a strange appearance, the Kitungulu specimen was exceptionally spinose and so unusual in its coloration that I noted it in full as follows:

Coloration in life. Kitungulu. Above, a triangular area from the snout to between the eyes is pale buff and is followed by another area, bounded by the parotids, which is brick-red, upon its anterior part two irregular, sepia-hued blotches, two larger ones on its posterior portion, these are followed by a circular area of pale buff which also exhibits irregular markings in sepia on its posterior extremity, this area is surrounded by a darker red one extending nearly to the vent;

sides of head and flanks pale buff vermiculated with black; limbs pale pink barred with black.

So striking and unusual was the coloring of this specimen that I could hardly bring myself to believe that it was only a Common Square-marked Toad. Moreover it was taken in a situation where one would have expected a dark and not a gaudy creature.

Measurements. The largest specimen is a female from Mwaya measuring 94 mm., both a Mangasini and Dabaga toad are 91 mm.

Breeding. At Bagamoyo, on November 11th, young ones were plentiful near waterholes close to the seashore, a toad taken at Mpwapwa on the 23rd was only 11 mm. in length.

At Mangasini, on December 14th, Square-marked Toads were calling "core-core" vociferously from the swamped flats. A frenzy of pairing was in progress, often several males were seen struggling for possession of one female; one male had clasped a female *Rana adspersa*. Both sexes of the toads were bright pinkish red on the hinder sides of the thighs, sometimes this color spread along the sides as far as the axilla.

An unpublished note made at Kilindini on May 3, 1926, states that two pairs were taken in embrace and released.

At Albertville, on May 21, ditches outside the town were literally swarming with little toads recently emerged from the tadpole stage.

Enemies. At Ilolo a young one was recovered from the stomach of a Rhombic Night Adder (*Causus rhombeatus*) and at Ujiji from a White-lipped Snake (*Crotaphopeltis h. hotamboeia*).

Habitat. Apart from those taken at waterholes, the following notes were made of occurrence of toads in other places. At Kilindini many were in holes a hundred yards from the shore, these were apparently crab holes from which the toads popped out their heads on hearing a footstep. At Tanga under *menti* or palm-frond thatching lying on the ground. At Mpwapwa in holes among the rotting roots of a tree stump. To my surprise I found several in open glades in the rain forest on Rungwe, some were in saw-pits in recent clearings, all were within half-a-mile of the forest edge and none in really dense forest. At Entebbe ten young ones were dug out of a termite hill.

Bufo carens Smith

Bufo carens A. Smith, 1849, Illus. Zoöl. S. Africa, **3**, pl. lxviii, fig. 1: Interior of Southern Africa.

1 (M. C. Z. 16387) Senjeri Pass, T. T. 5. v. 30.
1 (M. C. Z. 16388) Near Ikombo, N. R. 6. v. 30.

Habitat. Both were taken in roadside ditches.

Bufo urunguensis Loveridge

Bufo urunguensis Loveridge, 1932, Bull. Mus. Comp. Zoöl., **72**, p. 383: Kitungulu, Urungu, Tanganyika Territory.

5 (M. C. Z. 16376–9) Kitungulu, Urungu. 14. v. 30.

Coloration in alcohol. Above, uniform grey brown. Below, white, spotted or vermiculated with dark brown in the pectoral region.

Diet. Termites present in two of the paratypes examined.

Habitat. The first example of this interesting little toad was caught by me when I was on the march to Kitungulu; there was just sufficient light for me to see that it was a species new to me; I carefully wrapped it in my handkerchief but on reaching camp after an hour's stumbling among stones in the darkness, found that it had escaped. Next day we searched for more and were successful in securing five on the swampy floor of a patch of primary forest beside the river.

Bufo parkeri Loveridge

Bufo parkeri Loveridge, 1932, Bull. Mus. Comp. Zoöl., **72**, p. 382: Mangasini, Usandawi, Tanganyika Territory.

30 (M. C. Z. 16330–50) Mangasini, Usandawi. 14. xii. 29.

The diagnosis of this species has appeared already, the complete description follows:

Description. Crown without bony ridge; snout short, rounded, with very distinct canthus; interorbital space, concave, equal in width to an upper eyelid; tympanum only fairly distinct, longer than broad, its breadth equal to half the diameter of the eye. Fingers rather pointed, first considerably shorter than the second; toes scarcely webbed at base, with both simple and paired subarticular tubercles and laterally with minute spines; two moderate metatarsal tubercles; no tarsal fold; the tibio-tarsal joint reaches midbody; the tarso-metatarsal tubercle reaches the tympanum. Upper parts with round warts of unequal size, a series of enlarged ones along the lateral line; parotids feebly prominent with a tendency to break up into warts; warts on limbs, hands and feet often terminating in minute spines. Male with a large vocal sac.

Breeding. These toads were undoubtedly assembling for breeding in response to the breaking of the rains.

Habitat. The first heavy rains fell at 5 p.m. on the 12th and lasted till noon on the 13th. On going down to the semi-flooded flats when

it stopped I saw a great many small toads which at first I supposed to be young *B. r. regularis;* as I was returning it struck me as curious that there were no intermediates in size between them and the adult *regularis* which were pairing in every pool; picking one up I observed its chrome colored throat and so arranged for Salimu to return the following day and secure a series.

Bufo taitanus uzunguensis Loveridge

Bufo taitanus uzunguensis Loveridge, 1932, Occ. Papers Boston Soc. Nat. Hist., **8**, p. 44: Kigogo, Uzungwe Mountains, Tanganyika Territory.

2 (M. C. Z. 16380–1) Dabaga, Uzungwe Mtns. 1. i. 30.
2 (M. C. Z. 16382–3) Kigogo, Uzungwe Mtns. 23. i. 30.
1 (M. C. Z. 16384) Njombe, Ubena Mtns. 7. ii. 30.
1 (M. C. Z. 16385) Lukungu, Ubena Mtns. 8. ii. 30.
1 (M. C. Z. 16386) Nyamwanga, Poroto Mtns. 17. iii. 30.

Distribution. Nieden, in 1913, recorded *taitanus* from near Iringa and from Rungwe Volcano so that I was on the lookout for this small earless toad. It must, however, be scarce, for only seven examples were encountered, most of these were taken by myself as the natives probably confused them with the young of *Bufo r. regularis* which they closely resemble.

Native names. Tofula (Kihehe); *Ikiyula* (Kinyakusa).

Coloration in life. Kigogo. Above, brown, with a light yellow, hair-like line from snout to anus; a series of symmetrical black markings (very similar to those of *B. r. regularis*) on either side of this line; parotids chestnut-brown as also some of the lateral warts, otherwise sides grey almost obscured by large black patches; limbs grey-brown above barred with black; a V-shaped cream-colored spot above the anus. Below, white, cream-colored, marbled with brown and black.

Measurements. Length from snout to anus 21 to 29 mm., average 25 mm.

Habitat. Dabaga specimens were taken in swampy marshland beside a brook in the valley bottom. The Nyamwanga toad was hopping along on a sodden path which led through long grass up to the village.

Nectophrynoides vivipara (Tornier)

Pseudophryne vivipara Tornier, 1905, Sitzber. Akad. Wiss. Berlin, **2**, p. 855: Rungwe and Ukinga Mountains, Tanganyika Territory.

Nectophrynoides vivipara Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 191: Uluguru Mountains, Tanganyika Territory.

1 (M. C. Z. 16389) Kigogo, Uzungwe Mtns. 30. i. 30.
2 (M. C. Z. 16390–1) Nyamwanga, Poroto Mtns. 17. iii. 30.
56 (M. C. Z. 16392–400) Ngosi Volcano, Poroto Mtns. 18–20. iii. 30.
28 (M. C. Z. 16401–9) Nkuka Forest, Rungwe Mtn. iii. 30.

Distribution. The last listed specimens are topotypes. The Viviparous Toad is not nearly so abundant in any of these localities as it is in the Uluguru Mountains, it would appear to be even rarer in the Ukinga range than in the Uzungwe.

Coloration in life. Young toads from Ngosi were flecked with silvery-white below and had the dorsal area edged with a silvery-white line which gave them the appearance of young *Arthroleptis.*

Measurements. In the southwestern highlands the species does not appear to obtain to the large dimensions of specimens from the more tropical Uluguru. The largest from Ngosi Volcano is 48 mm., and the largest from the Nkuka Forest only 45 mm., not more than ten in the whole series are over 40 mm.

Breeding. Most of the Ngosi series consists of small toads of 11 mm. in length, the smallest from Rungwe is 12 mm. At the same time three adult females from both Ngosi and Rungwe held large eggs as was the case with the Nyamwanga female but the ova were small in the Kigogo toad.

Diet. Chiefly beetles, also cricket, caterpillar, spider and a wood-louse.

Parasites. In Rungwe these toads exhibit a heavy infestation of larval mites which show as small red specks on hands and feet.

Defence. When killed in chloroform the large glands on the back and limbs exude a considerable quantity of poison which is as fluid and white as cow's milk.

Habitat. The Kigogo toad was taken under a rotting log at the edge of rain forest. At Ngosi one adult was taken four feet from the ground where it was climbing through undergrowth, another in grass a foot from the ground, several half-grown in bamboo and others up in the wild bananas, the majority, however, were among the dead leaves carpeting the forest floor. On Rungwe it was a rare occurrence to meet with a viviparous Toad below the bamboo belt but they were quite common on the path where it passes through the bamboos near the summit of the mountain.

RANIDAE

Rana adspersa (Duméril & Bibron)

Pyxicephalus adspersus Duméril & Bibron, 1841, Êrpet. Gén., **8**, p. 444: South Africa.

4 (M. C. Z. 16473–6) Bagamoyo. 11. xi. 29.
12 (M. C. Z. 16477–86) Mangasini, Usandawi. 12–16. xii. 29.

Distribution. Recorded by Nieden from Dar es Salaam, Kilimatinde and Unyika.

Coloration in life. Of two frogs, taken from the same swamp at Bagamoyo, the throat of one was handsomely marbled with olive but showed no yellow, in the other the throat, chest, belly and sides were bright yellow.

Measurements. The Bagamoyo series range from 81 to 92 mm., those from Mangasini 94 to 138 mm., average of the whole series 110 mm.

Breeding. Dr. Rudolph Stohler has examined one of the Bagamoyo frogs and confirmed my opinion, based on two others, that they are immature. As they are not breeding one wonders why some of the series should have such bright coloring and others none. The deep note of *adspersa* was occasionally heard. The tadpoles found in the swamp are assumed to be those of *galamensis.*

At Mangasini a female *adspersa* was found in the embrace of a male *Bufo r. regularis.*

Diet. At Bagamoyo the stomach contents consisted of: (1) A cockchafer and a tremendous number of tadpoles, (2) fewer tadpoles and three species of cockchafers. At Mangasini, (3) a lizard (*Latastia johnstonii*) and quantities of winged termites, (4) a frog, apparently a young *R. adspersa*, grasshopper, beetle and polydesmid, (5–7) termites and Megaponera.

Parasites. An immature female ascarid was present in one Bagamoyo frog.

Enemies. The remains of a large frog were recovered from the stomach of a cobra (*Naja nigricollis*). Apparently tadpoles and young are preyed upon by the adults as related above.

Rana delalandii (Duméril & Bibron)

Pyxicephalus delalandii Duméril & Bibron, 1841, Érpet. Gén., **8**, p. 445, pl. lxxxvii, figs. 1, 1a, & 1b: South Africa.

36 (M. C. Z. 16487–500) Masiliwa, Turu. 9. xii. 29.
4 (M. C. Z. 16501–3) Mangasini, Usandawi. 14. xii. 29.
1 (M. C. Z. 16504) Kikuyu, Ugogo. 21. xii. 29.
1 (M. C. Z. 16505) Senjeri Pass, 5. v. 30.

Variation. I find that the key character which I employed in 1930 to distinguish this species from its allies does not hold for many of the specimens listed above which are bloated with termites; it would be better to say "the metatarsal tubercle of the adpressed hind limb reaches the eye" rather than that the tibio-tarsal articulation does so for the latter sometimes falls short.

Coloration in life. In life the sexes may be very differently colored dorsally as at Masiliwa where females were red and males mottled and darker. At Mangasini a 37 mm. male was taken embracing a 45 mm. female and the upper surface of both was essentially similar, *viz.* Above, greenish-white mottled and barred with dark green, such mottlings edged with black; markings, particularly on the head, like those of *B. r. regularis;* on back numerous round, chocolate-colored, black-edged spots. Beneath, however, the male's throat was greenish-black, that of the female like the rest of the undersurface—satiny-white with a slight greenish shading posteriorly. In alcohol the throats of males are black, those of females and immature frogs, white.

Measurements. Sixteen black-throated males range from 28 to 44 mm., average 34 mm.; omitting a few small specimens the twelve female adults range from 40 to 50 mm., with an average of 43 mm.

Breeding. Mating at Mangasini on December 14th at which time a female was bloated with eggs.

Diet. Those examined were gorged with flying termites, a few beetles were also found.

Habitat. As a tent site was being cleared at Masiliwa at 3 p.m. I captured a single frog; about sunset several more were found hopping about capturing termites which were flighting after a heavy shower which fell between 4 and 5 p.m. It began to rain again and so I went out from 8 to 9 p.m. to some recently hoed-over ground and captured a great many more. In all eighteen of either sex. They were associated with other burrowing types in the same field, viz. *Hemisus m. guineense* and *Breviceps mossambicus.*

The Kikuyu frog was taken hopping about at night and the Senjeri Pass specimen at 11 p.m. in a roadside ditch; these frogs are essentially nocturnal and effectively conceal themselves during the day.

Rana occipitalis Günther

Rana occipitalis Günther, 1858, Cat. Batr. Sal. Brit. Mus., p. 130, pl. xi: "West Africa," "Africa," Gambia.

1 (M. C. Z. 16506) Nyamkolo, Lake Tanganyika. 9. v. 30.
1 (M. C. Z. 16507) Kipili, Lake Tanganyika. 19. v. 30.
7 (M. C. Z. 16508–14) Ujiji, Lake Tanganyika. 28. v. 30.
3 (M. C. Z. 16515–7) Ukerewe Id., Lake Victoria. 10. vi. 30.
2 (M. C. Z. 16518–9) Kampala, Uganda. vi. 30.

Distribution. Also seen at Shinyanga. Nieden remarks that this species is rare in German East Africa; it would seem that the eastern limit of its range is about a hundred miles east of Lake Victoria.

Native names. Chula (Kifipa); *lunda* (Kimanyema).

Measurements. The Ujiji and whole series ranges from 25 mm. to 1,300 mm., the latter, a female, being the only fully adult frog.

Habitat. The big Ujiji frog was taken from a cement-lined pit twenty feet in depth as described under *Pelusios sinuatus* in the report on the reptiles. The young one from Kipili was captured in a lagoon close to the lake shore.

Rana fuscigula chapini Noble

Rana nutti (*nec.* Boulenger) Andersson, 1911, Svenska Vetensk.-Akad. Handl., **47**, No. 6, p. 26: localities in Kenya Colony. Procter, 1920, Proc. Zoöl. Soc. London, p. 412: Nairobi; Longido West; Morogoro. Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 194: localities in Uluguru and Usambara Mountains. Loveridge, 1929, U. S. Nat. Mus. Bull. 151, p. 98: localities in Kenya and Tanganyika.

Rana delalandii (part) Nieden, 1915, Mitt. Zoöl. Mus. Berlin, p. 352: Kilimanjaro to Nguru; Amani; Ukami; Mpwapwa.

Rana chapini Noble, 1924, Bull. Am. Mus. Nat. Hist., **49**, p. 214, text fig. 6a: Batama, Belgian Congo.

8 (M. C. Z. 16726–33) Mpwapwa, Ugogo. 23. xi. 29.

Distribution. Already, under the name of *delalandii*, recorded from Mpwapwa by Nieden.

The apparently discontinuous records of this frog will probably be connected by search in Uganda and on Mt. Elgon or by reëxamination of material from this region which has been identified as *fuscigula* and *angolensis* or *nutti*. Though it is the rain forest representative of *fuscigula*, in the highlands of Kenya and the Usambara Mountains *chapini* occurs in mountain streams apart from forest.

Variation. An Uluguru frog was submitted to Dr. G. K. Noble for favor of comparison with the type of *chapini;* in his reply he stated that he could detect no differences and considered them specifically identical. For further discussion on their relationships see *R. f. angolensis*, of which *nutti* Boulenger is a synonym.

Measurements. All eight specimens are juveniles just out of the tadpole stage, but from the data furnished below it will be seen that this form is the largest of all the races of *fuscigula.*

Noble's holotype ♂ 78 mm. (Belgian Congo.)

From a total of 25 frogs, Procter records the largest ♀ 83 mm. Of 193 frogs Barbour & Loveridge record ♂ 74 mm., ♀ 110 mm. (Uluguru). Of 148 Loveridge gives maximums as ♂ 65 mm., ♀ 95 mm. (Kenya).

I think that the reason for so few collectors obtaining examples of large size is to be attributed to the fact that the very big frogs keep to the swift-flowing streams. In consequence they are more difficult to catch as well as being harder to hold, so that natives, when bringing in frogs, are apt to confine their attention to the smaller individuals.

Rana fuscigula angolensis Bocage

Rana angolensis Bocage, 1866, Jorn. Sci. Math. Nat. Phys. Lisboa, p. 73: Duque de Bragança, Angola. Parker, 1931, Proc. Zoöl. Soc. London, 1930, p. 897: Amatongas, Mozambique.

Rana nutti Boulenger, 1896, Ann. Mag. Nat. Hist. (8), **18**, p. 467: Lake Tanganyika.

Rana delalandii (part) Nieden, 1915, Mitt. Zoöl. Mus. Berlin, p. 352: Ikombe; Kidugallo (Kidugala); Ubena; Ujiji; West Ruanda.

21 (M. C. Z. 16520–9) Dabaga, Uzungwe Mtns. 1. i. 30.
1 (M. C. Z. 16530) Panga Mawe, Uzungwe Mtns. 8. i. 30.
Spawn, tadpoles & 9 (M. C. Z. 16531–9) Kigogo, Uzungwe Mtns. 13. i. 30.
1 (M. C. Z. 16540) Lukungu, Ubena Mtns. 8. ii. 30.
1 (M. C. Z. 16541) Mangoto, Ukinga Mtns. 10. ii. 30.
12 (M. C. Z. 16542–51) Madehani, Ukinga Mtns. 10. ii. 30.
47 (M. C. Z. 16552–61) Ilolo, Rungwe. 15. iii. 30.
25 (M. C. Z. 16562–9) Nyamwanga, Poroto Mtns. 17. iii. 30.
3 (M. C. Z. 16570–2) Nkuka Forest, Rungwe Mtn. 8. iv. 30.
Tadpoles & 2 (M. C. Z. 16573–5, 17144) Tukuyu, Rungwe. 21. iv. 30.
2 (M. C. Z. 17145–6) Ujiji, Lake Tanganyika. 25. v. 30.

Distribution. Already under the earlier, but preoccupied, name of *delalandii* Duméril & Bibron, Nieden has recorded this frog from Ubena and Ujiji.

The Museum of Comparative Zoölogy possesses examples of this race from localities in the Cape Province and Orange Free State in the Union of South Africa; from Bella Vista, Angola; Waterfal Onder and Woodbush Village in the Transvaal; Behungi Escarpment, Uganda.

I have also examined large series in the Field Museum of Natural History from various localities on Mt. Ruwenzori, and from Lake Bunyoni and the Kigezi district of Uganda.

Native names. *Miula* (Kihehe); *chula* (Kikinga).

Affinities. Hewitt now considers that *angolensis* should be regarded as a race of *fuscigula* and I wholly concur with his action; such treatment offers a reasonable explanation of the apparent intergrades along the boundaries of the two forms.

Nieden, De Witte and others have long considered *nutti* Boulenger as a synonym, and it was in the hope of throwing more light on the much discussed relations of the group that I collected the above series. I am now convinced that *nutti* is a synonym.

The synonymy is very involved for a tangle arose as a result of Boulenger failing to differentiate a third form—*chapini* Noble and thus, using specimens of *chapini* which Boulenger had identified as *nutti*, I continued to use the name but have been in reality really referring to *chapini*. Other authors have likewise been talking at cross purposes.

More recently Parker (1931, *loc. cit.* p. 897) has suggested means for differentiating *angolensis* and *nutti* and provides a key. I imagine that his material was insufficient for in endeavoring to utilize this key I found all the characters very variable, the variations being largely correlated with age but by no means always so.

As the holotype of *nutti* could not be loaned, Mr. Parker kindly sent me one of the Ruwenzori frogs identified as *nutti* by Boulenger (1909, Trans. Zoöl. Soc. London, p. 240, pl. viii, figs. 1 and 2) and it was at once obvious that it was distinct from the Nairobi frogs (=*chapini*) identified for me as *nutti* by Mr. Boulenger in 1915. I then borrowed twenty-two Ruwenzori frogs from the Field Museum of Natural History; these are undoubtedly conspecific with Boulenger's Ruwenzori frogs and agree well with his excellent figures. The data from them may be arranged as follows.

In this Ruwenzori series of 22 frogs I found that the snout is from 1 1/5 (49 mm. frog) to 1 3/5 (27 mm. frog) the diameter of the orbit; the nostril is nearer the eye than to the end of the snout in 10 frogs, equidistant in 12; the tympanum varies from ½ (27 to 36 mm. frogs)

to 2/3 (38 to 67 mm. frogs) the diameter of the eye; the length of the foot is contained from 1 1/3 (48 to 50 mm. frogs) to 1 3/5 (67 mm. frog) times in the length from snout to anus.

As an independent check I asked a student, Mr. J. B. White, if he would be so kind as to measure up two lots in the present series. I am obliged to him for taking the following measurements and working out the propórtions.

In a Dabaga series of 17 frogs the snout is from 7/8 (22 mm. frog) to 1 4/5 (53 mm. frog) the diameter of the orbit; the nostril is nearer the eye than to the end of the snout in 11 frogs, equidistant in 3, and nearer the snout in 3; the tympanum varies from ½ (26 mm. frog) to 10/11 (53 mm. frog) the diameter of the eye; the length of the foot is contained from 1 3/5 (48 to 51 mm. frogs) to 2 (24 to 43 mm. frogs) times in the length from snout to anus.

In a Nyamwanga series of 17 frogs the snout is from 1 1/3 (24 mm. frog) to 1 5/6 (50 mm. frog) the diameter of the orbit; the nostril is nearer the eye than to the end of the snout in 6 frogs, equidistant in 5, and nearer the snout in 6; the tympanum varies from ¼ (46 mm. frog) to 2/3 (43 mm. frog) the diameter of the eye; the length of the foot is contained from 1½ (43 mm. frog) to 1 4/5 (25 to 74 mm. frogs) times in the length from snout to anus.

From this it will be seen that if a sufficient series be taken from any locality within its range, considerable instability is to be observed. An apparent increase in leg length as one proceeds from north to south may possibly be attributable to a disproportion of the sexes for the whole series of 1930 shows 57 in which the tibio-tarsal articulation falls short of the end of the snout, in most cases reaching the nostril, and 59 in which the tibio-tarsal articulation reaches beyond the end of the snout. There are two phalanges of the fourth toe constantly free of web. The whole series, with one exception, possess a tibia which is more than half the length from snout to anus; the single exception from Lukungu does not appear to differ in other characters from the rest of the series so I prefer to regard it as an abnormal *fuscigula*-like individual.

The three forms may be recognized as follows:

Length of tibia not more than half the length from snout to anus; fifth toe webbed to the very tip . . . . . . *f. fuscigula*

Length of tibia more than half the length from snout to anus; fifth toe webbed to the very tip . . . . *f. chapini*

Length of tibia more than half the length from snout to anus, last phalanx of fifth toe free of web . . . . *f. angolensis*

Coloration in life. Dabaga. Above, silvery-green or bronze to dark brown, an interorbital streak usually visible, a broad black patch from eye over tympanum; the whole upper surface is mottled with brown; the hind limbs are more or less distinctly cross-barred; no anal streak. Below silvery-white to cream; the lower jaws, throat and belly marbled with brown; the underside of the limbs opaquely greenish white.

In the Kigogo frogs the gular and abdominal vermiculations were less distinct but these frogs were taken some distance from water. The vertebral stripe of one Ilolo frog was bright vermilion, the only one seen of such a color.

Measurements. A quite exceptionally large ♀, the largest of the whole series measures 74 mm.

Breeding. Eggs, tadpoles and young frogs with stumpy tails were taken in a fast-flowing stream at Kigogo on 13. i. 30; tadpoles were found at Tukuyu on 21. iv. 30 and frogs with rudimentary tails at Ujiji on 25. v. 30.

Parasites. Parasites were common about the anus and posterior surface of the thighs in frogs from Dabaga and elsewhere.

Enemies. A young frog was recovered from the stomach of an immature Striped Schaapsteker (*Trimerorhinus t. tritaeniatus*).

Habitat. At Dabaga these handsome frogs rest in tussocks of grass beside the swiftly flowing brook into which they leap as one approaches. Some dive to the bottom, others come up among the numerous reeds and grasses growing from the water. While usually associated with the swiftly-flowing brooks in valley bottoms, at Madehani they were often encountered away from water in long sodden grass, or among the leaves of the bamboo forest; an even more surprising situation was among the leaves on the floor of the dark rain forest, a situation in which I captured several in the depths of the Nkuku Forest on Rungwe.

Folklore. The first Kigogo frog was brought by an Mbena lad who had tied it between two sticks, I told him to hold it by the hind leg and he replied, "No, no, I'm afraid of it." However, I told him not to be silly whereupon he took it from me and carried it to camp. I found a revulsion to handling frogs quite common among the Wabena though without ascertaining the cause.

Rana galamensis Duméril & Bibron

Rana galamensis Duméril & Bibron, 1841, Érpet. Gén., **8**, p. 367: Galam Lakes, Senegal.

Rana bravanus Tornier, 1897, Kriechthiere Deutsch-Ost-Afrikas, p. 92, fig. f.: Bagamoyo, etc.
Rana bravana Nieden, 1915, Mitt. Zoöl. Mus. Berlin, **7**, p. 351: Localities in Tanganyika Territory.

Tadpoles and 3 (M. C. Z. 16576–8) Bagamoyo. 16. xi. 29.
1 (M. C. Z. 16579) Ukerewe Id.. Lake Victoria. 14. vi. 30.

Distribution. I had previously collected this frog at Bagamoyo and Bukoba; Nieden has recorded it from Pemba and Zanzibar.

Affinities. Despite Nieden's contention that *bravana* should be considered distinct from *galamensis*, I adhere to Boulenger's reiterated opinion that the two are synonymous; presumably the point will not be definitely settled until fresh material from the Galam lakes is available.

Variation. It seems very doubtful if Boulenger's *R. darlingi* from Mashonaland is more than a race, or even distinct; in 1910 the only points on which he could separate it were that the vomerine teeth were behind the level of the choanae (between in *galamensis*) and the tibiotarsal articulation of the adpressed hind limb reaching between the eye and the tip of the snout (not reaching beyond the eye in *galamensis*). In the eight examples from Zanzibar and Tanganyika Territory in the collection of the Museum of Comparative Zoölogy it reaches from the hind end of the eye to between the eye and nostril; the vomerine teeth are certainly between the choanae in this series but they are very variable in size and exact location. Tornier (1897) has figured some of these variations.

Measurements. All adult, the males measure 67 to 71 mm., and the females 73 to 75 mm.

Coloration. The white streak on the lips and the brown lateral stripes make this species easy to distinguish. The males have black vocal pouches.

Breeding. Tadpoles collected on November 11th at Bagamoyo may possibly be referable to *R. adspersa*. They swarmed in seething masses or shoals which set the water in commotion, the patches of tadpoles cover areas of a foot to eighteen inches in length by half as much in width.

Habitat. This is the most secretive of any of the East African ranae; it keeps to grass-grown, deep-water swamps apparently and though noisy enough, dives at the slightest disturbance in its vicinity. It is little wonder that, despite its wide distribution, it is scarce in collections. After vainly trying for an hour to locate some in a swamp, one was observed on damp ground at the edge of a pool measuring twenty

feet long by fifteen across but only knee-deep in the centre. Clumps of rushes grew in the shallow edges of the pool, rank sedges or papyrus almost to the edge. I had all this cut down and cleared away till the place was bare for Salimu said that he had heard two frogs calling "meow-meow" in this pool. We caught the larger frog seen on land which proved to be a female and after much waiting we secured two males and also an *adspersa*. They call louder and continuously when the sun shines but become silent, except for an occasional call, when it rains.

Rana floweri Boulenger

Rana floweri Boulenger, 1917, Ann. Mag. Nat. Hist. (8), **20**, p. 417: Rosaires, Blue Nile. Type a ♀.

Rana barbouri Loveridge, 1925, Proc. Zoöl. Soc. London, p. 776: Nyambita, Mwanza, Tanganyika Territory. Type a ♀.

Abrana cotti Parker, 1931, Proc. Zoöl. Soc. London, p. 898: text fig. 1, Charre, Mozambique. Type a ♀.

24 (M. C. Z. 16580–99) Mangasini, Usandawi. 14. xii. 29.
1 (M. C. Z. 16600) Shinyanga, Usukuma. 3. vi. 30.

Distribution. It might be remarked that Shinyanga is not very far south of Nyambita, the type locality of *barbouri*. This frog, superficially so like *Rana oxyrhynchus* but with shorter hind limbs, evidently ranges from the Sudan to Mozambique.

Affinities. Boulenger described *floweri* on the basis of a single female which he considered closely related to the subgenus *Ptychadena;* when I described *barbouri* I relegated it to the subgenus *Hildebrandtia* being in error in supposing it had a hair-like clavicle. Parker points out that his eight specimens lack clavicles and proposes a genus for them which he calls *Abrana*. It is a matter of personal opinion whether *Abrana* merits full generic rank; to me it appears a mistake to mask a frog of so distinctly a ranid appearance by erecting a new genus for its reception, I prefer to consider *Abrana* a subgenus of *Rana*. Mr. Parker has kindly examined *floweri* and fully concurs that *cotti* is synonymous but would retain *Abrana* as a full genus. I have compared the holotype of *barbouri* with a paratype of *cotti*. Other examples of this frog in the collection of the Museum of Comparative Zoölogy are from Giza, Egypt and Frere Town, Kenya Colony.

Variations. Parker has already pointed out some interesting variations in his paratypes; if one compiles a new description based on the three earlier descriptions it will be found to cover most of the varia-

tions. Boulenger speaks of a small flat outer metatarsal tubercle while Parker and myself say that there is no outer tubercle. There is no trace of it in the type of *barbouri* and it is absent in nine males and three females of the Mangasini series but quite distinct in nine males and one female from the same locality, it is large in the two young of 33 and 34 mm. The tibio-tarsal articulation marks the tympanum in two frogs, the posterior border of the eye in ten, the anterior border of the eye in eleven and beyond that in one (M. C. Z. 16599). Though apparently conflicting it is equally true to say that the snout is pointed and abruptly truncated at the tip. In the field I made a note to the effect that the dorsal and dorso-lateral folds almost entirely disappear when these frogs are immersed in water for from 24 to 48 hours; this is the condition in the type of *barbouri;* Parker has also remarked on the inconstancy of these glandular folds in his series.

Measurements. Eighteen males range from 42 to 49 mm., average 45.5 mm.; three females are from 43 to 48 mm., average 46.2 mm.; young are 33 and 34 mm.

Breeding. The males were assembling after the first downpour of the rains and vast numbers were pairing in the water of the flooded flats. Males were calling and apparently sometimes inflated the abdominal skin instead of the singing pouches. Whatever the cause, accidents occurred in which the abdominal skin becomes inflated, this causes the frog to turn over on to its back when it flounders helplessly; a round, white, globular skin the size of a ping-pong ball being all that is to be observed floating on the water at a short distance. Two frogs were caught in this condition.

Diet. Spiders in one examined.

Habitat. While the Mangasini frogs were found as described in the note on breeding above, the Shinyanga specimen was captured in my bedroom where it was jumping against the walls and had been doing so apparently for some time as the terminal joints were already worn off its toes.

Rana oxyrhynchus Smith

Rana oxyrhynchus A. Smith, 1849, Illus. Zoöl. S. Africa, **3**, pl. lxxvii, figs. 2, 2a–c: Kafirland and region of Port Natal.

Rana theileri Mocquard, 1906, Bull. Mus. d'Hist. Nat. Paris, p. 252: Nelspruit, Transvaal.

8 (M. C. Z. 16601–8) Bagamoyo. 9. xi. 29.

8 (M. C. Z. 16618–25) Kipili, Lake Tanganyika. 19. v. 30.

Distribution. Nieden has recorded this species from Dar es Salaam, Mpwapwa, Tukuyu and Ujiji.

Affinities. There is nothing in the description of *R. theileri* to lead one to suspect that this frog differs from *R. oxyrhynchos* and I am indebted to Mr. V. FitzSimons for confirming this opinion after examining the series of *oxyrhynchus* from Nelspruit in the Transvaal Museum.

Variation. Mostly young specimens in which the hind limbs appear rather short, the body is included in the total length of the hind limb 1.5 to 1.9 times in the Bagamoyo series, 1.7 to 2.1 times in the Kipili frogs, the averages being 1.7 and 1.9 respectively.

Coloration in life. See habitat.

Measurements. Largest male measures 40 mm.; the largest female 45 mm., both are from Bagamoyo; average length of the Bagamoyo frogs is 30 mm., and of those from Kipili 31 mm.

Habitat. At Bagamoyo they were taken in water holes on the sea front where they exhibited great variety in color and markings. At Kipili scores of these frogs, grey to sandy in color, occasionally pink or still more rarely with a green vertebral stripe, were resting on the damp sand within five feet of a stagnant little lagoon very close to the edge of the lake. As one walked along they leaped towards the water in astonishing numbers, it was like walking through a swarm of locusts.

RANA MASCARENIENSIS MASCARENIENSIS Duméril & Bibron

Rana mascareniensis Duméril & Bibron, 1841, Erpét. Gén., **8**, p. 350: Madagascar; Mauritius; Seychelles.

9 (M. C. Z. 16609–17) Mwaya, Lake Nyasa. 1–8. iii. 30.
3 (M. C. Z. 16640–2) Tukuyu, Rungwe. 13. iii. 30.
3 (M. C. Z. 16643–5) Ilolo, Rungwe. 15. iii. 30.
151 (M. C. Z. 16646–57) Nyamkolo, Lake Tanganyika. 9. v. 30.
4 (M. C. Z. 17826–9) Kitungulu, Urungu. 14. v. 30.
1 (M. C. Z. 16658) Kasanga, Lake Tanganyika. 16. v. 30.
12 (M. C. Z. 16659–68) Ujiji, Lake Tanganyika. 28. v. 30.
3 (M. C. Z. 16669–71) Ukerewe Id., Lake Victoria. 14. vi. 30.

Distribution. Recorded from Bagamoyo, Dar es Salaam, Tukuyu and Ukerewe Island by Nieden.

Native name. Makeri (Kijiji).

Variation. The Mwaya series was measured for head into hind limb length and was found to be 1.7 to 1.9, i.e. within the range of *R. oxyrhynchus.*

Measurements. Omitting the 160 young under 33 mm., the fifteen

males measure from 33 to 46 mm., average 39 mm.; the eleven females measure from 33 to 53 mm., average 44 mm.

Breeding. Great numbers were calling "quek-quek" in the swamp eight miles west of Bagamoyo town. The Mwaya female is distended with ova. At Tukuyu three males were taken as they were calling from a shallow pool, a clear, ringing, liquid note something suggestive of a bursting bubble and "bob-white." When caught and placed in a bag they only gave utterance to the "quek-quek" cry. At Nyamkolo scarcely any adults were seen but young were present in thousands in the swamped grasslands at the edge of the lake where their green vertebral stripe might serve a useful purpose. At dusk they leave the swamped grass for the adjacent meadowland.

Enemies. Recovered from the stomach of a Cattle Egret (*Bubulculus ibis*) at Bagamoyo, from a Hissing Sand Snake (*Psammophis sibilans*) at Nyamkolo, from a Lined Snake (*Dromophis lineatus*) at Ujiji, and it was apparently this species of frog which was found in a water snake (*Grayia tholloni*) on Ukerewe Island.

Habitat. Abundant in swamps or on the lake shore at Mwaya, Nyamkolo and Kasanga.

Rana mascareniensis uzungwensis Loveridge

Rana mascareniensis uzungwensis Loveridge, 1932, Bull. Mus. Comp. Zoöl., **72**, p. 384: Dabaga, Uzungwe Mtns., Tanganyika Territory.

12 (M. C. Z. 16626–35) Dabaga, Uzungwe Mtns. 1. i. 30.
3 (M. C. Z. 16636–8) Kigogo, Uzungwe Mtns. 13. i. 30.
1 (M. C. Z. 16639) Lukungu, Ubena Mtns. 8. ii. 30.

Breeding. Males were assembling in a patch of boggy land at Dabaga where only one female, the type, was taken, this specimen was full of ova. At Kigogo a young female measuring 28 mm. was captured.

Habitat. The type series was taken in boggy land bordering a swiftly flowing brook in the bottom of the valley on the left side of the road as one approaches Mr. A. K. Hauter's farm from the direction of Iringa.

Rana mascareniensis venusta Werner

Rana venusta Werner. 1907, Sitzber. Akad. Wiss. Wien, **116**, part 1, pp. 1889, and 1892, pl. iv. fig. 11: Entebbe, Uganda; Mongalla and Lagos.

4 (M. C. Z. 16672–5) Entebbe, Lake Victoria. 27. vi. 30.

Distribution. This is the large western form of *mascareniensis*, its distribution more or less coinciding with that of the rain forest. The above specimens are topotypes.

Measurements. Only the male is fully grown, measuring 49 mm., the larger young female measures 40 mm.

Variation. The width of the interorbital space in its relation to the width of an upper eyelid proves valueless for distinguishing this race from the typical form. Nor are the markings on the buttocks constant though the light line is usually present. The race, however, may be told by the difference in webbing of the toes and its larger size, females attaining a length of 63 mm.

Rana ansorgii Boulenger

Rana ansorgii Boulenger, 1905, Ann. Mag. Nat. Hist. (7), **16**, p. 107, pl. iv, fig. 1: Between Benguella and Bihé, Angola; Parker, 1931 (1930), Proc. Zoöl. Soc. London, p. 898: Amatongas, Mozambique and Sibundeni, Zululand.

12 (M. C. Z. 16676–85) Kitungulu, Urungu. 14. v. 30.

Distribution. These examples constitute the first record of the occurrence of this species in Tanganyika Territory.

Affinities. Two frogs from this series were submitted to Mr. H. W. Parker for favor of comparison with the type, with the figure and description of which they appeared to be in accord. Mr. Parker replied: "These two agree perfectly with specimens from the Victoria Falls, determined by Boulenger as *R. ansorgii.* I have also compared them with the type and find very close agreement."

The species seems to represent a still further development beyond *R. m. uzungwensis* in the direction of the *Rana fasciata* group for in *ansorgii* the 1st, 2nd, 3rd and 5th toes have two joints completely free of web as against one, or one and a half, in *mascareniensis*, the 4th toe in the latter has two joints free as against three free joints in *ansorgii.* The tibio-tarsal articulation of the adpressed hind limb extends far beyond the tip of the snout.

Coloration in life. These frogs were of a bright straw shade similar to that of *Rana fasciata merumontana.*

Measurements. All are females and range from 23 to 31 mm. in length.

Habitat. The series was found in swamped forest land where most of the trees had been recently felled, the spot was only fifty feet from a swiftly flowing stream.

Rana fasciata merumontana Lönnberg

Rana merumontana Lönnberg, 1907, in 1910, in Sjöstedt, Kilimandjaro-Meru Exped., **1**, pt. 4, p. 21, pl. i, figs. 4a & 4b: Mt. Meru, Tanganyika Territory.
Rana fülleborni Nieden, 1910, Sitzber. Ges. Naturf. Freunde Berlin, p. 436: Crater Lake of Ngosi Volcano, Tanganyika Territory.
Rana fasciata merumontana Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 197: Phillipshof, Usambara Mtns., Tanganyika Territory.

4 (M. C. Z. 16686–9) Dabaga, Uzungwe Mtns. 1. i. 30.
2 (M. C. Z. 16690–1) Kigogo, Uzungwe Mtns. 13. i. 30.
1 (M. C. Z. 16692) Mangoto, Ukinga Mtns. 10. ii. 30.
4 (M. C. Z. 16693–6) Madehani, Ukinga Mtns. 19. ii. 30.
58 (M. C. Z. 16697–725) Nyamwanga, Poroto Mtns. 17. iii. 30.

Distribution. The East African race of the South African and Angolan *R. f. fasciata* is only known from the localities in the citations above and the recently collected material of which the big series from the Poroto Mountains are practically topotypes, one at least coming from the slope of Ngosi Volcano.

Native names. Jeraboka (Kihehe); *chula* (Kikinga).

Variation. Rana fülleborni is something of an intermediate between the typical form and *merumontana*. Unfortunately our South African material has not been preserved in the same way as the East African which makes comparisons rather difficult. The sharply distinct dorso-lateral ridges or folds of *fasciata* which tend to be broken up in *merumontana* may owe their distinctness in part to preservation in strong alcohol, however that may be the topotypes of *fülleborni* cannot be distinguished from Usambara specimens of *merumontana* on this character though the dorso-lateral folds average a better development in frogs from the Poroto Mountains.

Another supposedly distinguishing character is the interorbital width in its relation to that of an upper eyelid, twice the width of an upper eyelid in *merumontana*, equal to it in *fülleborni*. Each frog of the Poroto series was examined as soon as chloroformed and a note made that in all the interorbital space equalled an upper eyelid in width; after a year, first in formalin, then in alcohol, however, there is considerable variation from 1 to 1¾ times; certainly they average the same in this respect as the big series from the Usambara Mountains. There is no difference in the position of the nostril which agrees with the variation given in the 1928 citation above.

One frog which lacks a right hind leg appears to have never developed it.

Coloration in life. Dabaga. Above, straw-brown, a conspicuous yellowish green vertebral streak bordered on either side by a black raised skin fold extending from snout to anus, a more straw-colored streak edged above and below with black, commences at the eye and merges into the abdominal coloring in front of the groin, below this anteriorly is a broad dark brown streak from eye to fore limb which is buff, mottled with brown; an anterior and a posterior streak on the tibia continued on foot and for a short distance on the thigh, the dorsal area between these streaks buff, faintly mottled or marbled with brown. Below, cream, very inconspicuously sprinkled with brown on the throat, undersides of the limbs colorless, the bones more or less sharply distinguishable through the skin.

A young one taken in boggy ground at the foot of Ngosi Volcano was bright yellow like the local *Hyperolius marginatus* which were common in the same locality, and strikingly different from the adults of its own species. The throats of the Nyamwanga series are slightly dusky, even freckled in some of the males as in the type of *fülleborni.*

Measurements. The largest specimens from all localities were females and measured 50 mm., which would appear to be the maximum size as the largest of a hundred and six Usambara frogs was 46 mm.

Breeding. A Dabaga female is distended with ova.

Diet. Beetles, grasshoppers and a walking-stick insect.

Habitat. To the notes already furnished on the Usambara frogs one might add that at Dabaga, Mangoto and Nyamwanga our series were taken in the long lush grass of the valleys, these situations were generally near streams. At Kigogo, however, they were found on a hill top far from water, the long grass in which they lived was apparently very dry but at its roots there was shade and moisture.

Phrynobatrachus natalensis (Smith)

Stenorhynchus natalensis A. Smith, 1849, Illus. Zoöl. S. Africa, **3**, Appendix, p. 24: Port Natal.

1 (M. C. Z. 16893) Mpwapwa, Ugogo. 22. xi. 29.
2 (M. C. Z. 16894–5) Mufindi-Njombe Road. 6. ii. 30.
1 (M. C. Z. 16896) Below Senjeri Pass. 5. v. 30.
1 (M. C. Z. 16897) Ukerewe Id., Lake Victoria. 14. vi. 30.
2 (M. C. Z. 16898–9) Kampala, Uganda. vi. 30.

Distribution. Nieden records this species from Zanzibar, Mpwapwa and Unyika.

Coloration in life. The male from Mufindi-Njombe Road had a very broad, pale brown, vertebral band; most unusual in this species.

Measurements. The four males range from 19–31 mm., average 26 mm.; the three females 30–34 mm., average 32 mm.

Breeding. Calling on February 6th from rain-filled ruts.

Habitat. The pair from near Mufindi, as well as the frog from the Senjeri Pass, were taken from rain-filled ruts in the road.

PHRYNOBATRACHUS ACRIDOIDES (Cope)

Staurois acridoides Cope, 1867, Journ. Acad. Nat. Sci. Philad., **6**, p. 198: Zanzibar.

Skeleton and 3 (M. C. Z. 16886–9) Miritini, Kenya Colony. 30. x. 29.
3 (M. C. Z. 16890–2) Changamwe, nr. Mombasa. 31. x. 29.
3 (M. C. Z. 16851–3) Mpoponi, Zanzibar. 21. x. 29.
21 (M. C. Z. 16854–63) Bagamoyo, T. T. 9. xi. 29.
3 (M. C. Z. 16864–6) Unyanganyi, Turu. 5. xii. 29.
1 (M. C. Z. 16867) Handa, Usandawi. 10. xii. 29.
1 (M. C. Z. 16868) Mwaya, Lake Nyasa. 1–8. iii. 30.
1 (M. C. Z. 16869) Kasanga, Lake Tanganyika. 16. v. 30.
5 (M. C. Z. 16870–4) Kipili, Lake Tanganyika. 19. v. 30.
2 (M. C. Z. 16875–6) Shinyanga, Usukuma. 3. vi. 30.
17 (M. C. Z. 16877–85) Ukerewe Id., Lake Victoria. 14. vi. 30.

Distribution. Already recorded from Zanzibar, Bagamoyo, Dar es Salaam, Mpwapwa, Iringa and Tukuyu by Nieden.

Native name. Koko (Kinyakusa).

Variation. I feel confident that digital disks are a breeding season development, they are present only in the Zanzibar, Bagamoyo and Mwaya frogs; that they are not present in the Miritini and Changamwe specimens may be attributed to the low grade local spirit in which, as an emergency measure, I had to preserve specimens from these places.

Coloration in life. While the majority of the Miritini frogs were brown, quite a number were bright green; on placing them in a bag, however, they all changed to brown. At Changamwe also, both green and brown frogs were present. The Kipili frogs were sand colored in which they resembled those from Dar es Salaam mentioned in the 1928 report.

Breeding. On October 30th at Miritini a torrential downpour of rain formed pools in the grass beside the railway line, actually there had been several showers daily since the 27th inst. A chorus of calls

came from the pools and, on close examination, I found these frogs abundant on the edge of one of the pools.

At Changamwe I visited a pool on October 31st; at the spot where these frogs were calling and a few pairs were found in embrace it was about six inches deep. The beaten-down blades of grass which lay on the surface of the water, held a narrow edging of spawn along their length, on some the spawn had already begun to take definite shape. There were also some patches of spawn about eight inches in diameter floating on the surface of the water free of grass, this appeared to be caused by all, or almost all, the available grass being occupied.

At Bagamoyo, on November 11th, frogs of this species were calling vociferously the sound being like a miniature rattle; these frogs were in the large swamps eight miles west of the town. They were also abundant in waterholes where tadpoles, either of this species or of *Rana m. mascareniensis* were numerous; the water holes were in sandy soil, almost on the shore.

The Mwaya frog is a female distended with ova. Most of the frogs from Ukerewe Island are young, the smallest (M. C. Z. 16877) being 12 mm. in length from snout to anus.

Enemies. The Mwaya frog was recovered from the stomach of an Eyebrowed Viper (*Vipera superciliaris*).

Habitat. Unyanganyi frogs were taken in boggy ground in an *mbugwe;* the Handa specimen from a water hole in the valley bottom; the Kasanga frog at the edge of the lake; at Kipili in pools in sandy flats close to the lake; at Shinyanga in big pools in an otherwise dried-up and sandy river bed; on Ukerewe Island they were found on the sand along the edge of a slow-flowing stream.

PHRYNOBATRACHUS PERPALMATUS Boulenger

Phrynobatrachus perpalmatus Boulenger, 1898, Proc. Zoöl. Soc. London, p. 479, pl. xxxviii, fig. 1: Lake Mweru, N. Rhodesia.

Phrynobatrachus perpalmatus werneri Ahl, 1924, Zoöl. Anz., **60**, p. 273: El Grassi etc., Sudan.

44 (M. C. Z. 16900–25) Nyamkolo, Lake Tanganyika. 9. v. 30.
2 (M. C. Z. 17142–3) Sumbwa, Lake Tanganyika. 20. v. 30.

Distribution. The type locality of this species is exactly 130 miles due west of Nyamkolo; the Sumbwa specimens constitute the first record of the occurrence of this species in Tanganyika Territory.

Affinities. In 1924 Ahl proposed the name *werneri* for Sudanese specimens which he alleged differed from the type in:

(i) web on the 4th toe being somewhat shorter
(ii) interorbital space somewhat broader than an upper eyelid
(iii) tympanum completely hidden
(iv) 1st finger is obviously shorter than the 2nd.

In his original description Boulenger stated:

(i) toes entirely webbed
(ii) interorbital space a little narrower than an upper eyelid
(iii) tympanum feebly distinct
(iv) 1st finger not extending quite so far as 2nd.

Boulenger, when stating that the toes were entirely webbed, was not anticipating the fine distinctions of some later taxonomists, actually the 4th toes may not be webbed to the tip. In the Nyamkolo series the interorbital space may be much narrower or much broader; in fact M. C. Z. 16914 has it nearly twice as broad, has the tympanum indistinguishable on the right side of the head yet clearly distinct on the left, while the presumed difference in the matter of finger length between Boulenger's and Ahl's frogs is purely imaginary.

Breeding. The breeding season was obviously over at Nyamkolo and the series ranges from adults to frogs (with unabsorbed tails) which measure 8 mm. in length from snout to anus.

Diet. Minute beetles.

Habitat. Next to *R. m. mascareniensis* this species appears to be the most abundant in numbers of any frog at Nyamkolo. Both inhabit the same swamped grasslands interspersed with reeds which makes sweeping with a net difficult. They scoot along the surface of the water with great rapidity and are harder to catch than the Mascarene Frog, the variegated shades of green which is their livery tends to conceal them when they come to rest. They begin to call about an hour before sunset and continue till the rising sun grows too hot, or so it seemed. The combined noise of many hundreds is somewhat like the tink-tonk of tiny hammers beating on little anvils. When it can be isolated, however, it will be observed that a single cry is very metallic and reminds one of the individual notes of the musical instrument so commonly carried by East African natives.

Arthroleptis stenodactylus stenodactylus Pfeffer

Arthroleptis stenodactylus Pfeffer, 1892 (1893) Jahrb. Hamburg Wiss. Anst., **10**, p. 93: Kihengo, Tanganyika Territory; Barbour & Loveridge, part, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 207: Dar es Salaam specimens only.

3 (M. C. Z. 16926–8) Bagamoyo. 8. xi. 29.

6 (M. C. Z. 16929–34) Mpwapwa, Ugogo. 23. xi. 29.
1 (M. C. Z. 169357) nr. Ikombo, N. Rhodesia. 6. v. 30.
9 (M. C. Z. 169358–43) Kitungulu, Urungu. 14. v. 30.

Distribution. Nieden's records, like those in the 1928 citation above, appear to be composed of typical *stenodactylus* and the mountain form which I have recently described under the name of *A. s. uluguruensis.*

Correction. On this last expedition an effort was made to get as much material of this group as possible to check the opinion which I held in 1928 that *variabilis* Matschie and *whytii* Boulenger were synonyms of *stenodactylus.* Now with almost topotypic material of *stenodactylus* and of *whytii* I must reverse that opinion and recognize both *whytii* and *variabilis* as distinct.

Of the material listed under *stenodactylus* in 1928 only the Dar es Salaam specimens are really of the typical form all the material from the Uluguru and Usambara Mountains being of the mountain race.

Affinities. *A. s. stenodactylus* is the most specialized burrowing member of the group, its spade-like inner metatarsal tubercle is larger and its toes a trifle shorter than in *A. whytii,* it is doubtful whether the two can be distinguished except by actual comparison; *stenodactylus* appears to have shorter limbs though this may be illusory rather than actual.

Variation. In addition to the material listed above six other specimens from Dar es Salaam, Dutumi and Kilosa have been used. In these twenty-five frogs the tibio-tarsal articulation reaches the axilla only in three, the tympanum in fifteen, the eye in four; the 1st finger usually equals the 2nd but is sometimes a trifle longer or shorter; the tips of the toes are *not* swollen or dilated; the shovel-shaped metatarsal tubercle is *always* longer than the inner toe; the length from the snout to anus is included in that of the hind limb from 1.12 to 1.58 times, average 1.33.

Coloration in life. Kitungulu. Above, pinkish-brown, a fine light yellow vertebral line from the snout to the anus, just above the anus it is crossed at right angles by a similar light line extending right and left to the inner aspects of the knee joints, the chain-like dorsal markings typical of the genus are usually present though sometimes absent, a dark streak commences at the nostril and passes through the eye to the tympanum; the lips are more or less regularly mottled with pale grey and white. Below, the throat, chest and anterior part of the belly are china-white, the underside of the limbs colorless, the soles of the hands and feet dusky.

Measurements. The largest frog, a female from Mpwapwa, measures 34 mm.

Diet. Mostly termites, a beetle in one and what appeared to be an earthworm in another.

Enemies. Three were recovered from the stomach of a Sharp-snouted Snake (*Rhamphiophis rostratus*) at Dar es Salaam.

Habitat. The Bagamoyo frogs were taken in sandy soil in the shade of a mango tree, in sandy soil at the base of a banana, and among leaves under a tree close to the seashore. All six Mpwapwa frogs were in holes among the decayed roots of a tree stump where they appeared to be aestivating as their stomachs were empty. The Ikombo and Kitungulu frogs in dry woodlands on red soil, an environment and climate closely resembling that at Kilosa.

Arthroleptis whytii Boulenger

Arthroleptis whytii Boulenger, 1897, Proc. Zoöl. Soc. London, p. 802: Kondowe to Karonga, Nyika Plateau, Masuku Mountains.

2 (M. C. Z. 16935–6) Mwaya, Lake Nyasa. 3. iii. 30.
7 (M. C. Z. 16944–8) Outside Nkuka Forest. iii. 30.
2 (M. C. Z. 16953–4) Tukuyu, Rungwe. 21. iv. 30.

Affinities. These frogs are from very near the type locality as Mwaya is only thirty miles from Karonga; a comparison with Boulenger's figure of the type shows them to be specifically identical. The difficulty of separating this species from *stenodactylus* has been discussed under the latter.

Variation. The tibio-tarsal articulation marks the eye; the inner metatarsal tubercle, though spade-like, is not so developed as in *stenodactylus* but still is longer than the inner toe; the length from the snout to the anus is included in that of the hind limb from 1.13 to 1.63 times, average 1.36.

Measurements. The largest frog, a male from the Nkuka Forest edge, measures 28 mm.

Breeding. None were breeding and the small size of the Mwaya specimens indicates that the season had passed.

Diet. The identifiable stomach contents consisted of: (1) a frog of apparently the same species and five beetle larvae, (2) spinose caterpillar and a snail, (3 & 4) snails, (5) and (6) grasshoppers.

Parasites. Female oxyuroid worms and parts of a proteocephalid cestode were present in one.

Enemies. One of these frogs was recovered from the stomach of a

Green Snake (*Chlorophis hoplogaster*) at Ilolo, and apparently what was a young *whytii* in the stomach of a larger frog of this species.

Habitat. The young were taken among leaves in wet woods at Mwaya, the adults were captured by myself in the wet roadway just below the Nkuka Forest and belong to the plateau fauna. None was taken within the forest where most of our collecting was done; in the forest their place is taken by the closely related *A. reichei.*

Arthroleptis adolfi-friederici Nieden

Arthroleptis adolfi-friederici Nieden, 1910, Sitzber. Ges. Naturf. Freunde Berlin, p. 440, and 1912, Wiss. Ergebn. Deutsch-Zentral-Afrika-Exped., 4, p. 175, pl. v, figs. 4a–c: Rugege Forest, Belgian Ruanda. Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl. **50**, p. 212: Localities in Uluguru and Usambara Mtns., Tanganyika Territory.

1 (M. C. Z. 16952) Ngosi Crater, Poroto Mtns. 19. iii. 30.

Distribution. This species has been recorded by Nieden as occurring on Rungwe.

Variation. The tibio-tarsal articulation reaches far beyond the end of the snout.

Measurements. This frog, a female, is 46 mm. in length or 4.5 mm. longer than the type.

Habitat. Taken as it was hopping on the sodden forest floor within the crater.

Arthroleptis reichei Nieden

Arthroleptis reichei Nieden, 1910, Sitzber. Ges. Naturf. Freunde Berlin, p. 440: Crater Lake, Ngosi Volcano, Tanganyika Territory.

1 (M. C. Z. 16949) Kigogo, Uzungwe Mtns. 23. i. 30.
2 (M. C. Z. 16950–1) Madehani, Ukinga Mtns. 19. & 22. ii. 30.
3 (M. C. Z. 16955–7) Ngosi Volcano, Poroto Mtns. 19. iii. 30.
80 (M. C. Z. 16958–75) Nkuka Forest, Rungwe Mtn. iii. 30.

Distribution. Hitherto only known from the type; the Ngosi Volcano series are topotypes.

Native names. *Buluwidi* (Kikinga); *koti* (Kinyakusa).

Affinities. Somewhat intermediate between *A. whytii* (from which it may be distinguished by the pronounced disks on the toes of *reichei*) and *A. adolfi-friederici* (from which it differs in possessing a first finger that is *very* much shorter than the second, and in its smaller size). In *adolfi-friederici* the first finger equals the second or is only a little shorter.

Variation. There is little to add to the excellent description except that occasionally the tibio-tarsal articulation of the adpressed hind limb reaches as far as the end of the snout.

Coloration in life. Ngosi Volcano. 25 mm. ♂. Caught in a wild banana. Above, straw colored and very much like a young *A. s. stenodactylus* but soon changed to a greenish-grey; a dark ⌣ shaped marking edged with white anteriorly, unites the upper eyelids; a sepia-brown line from the nostril crosses the edge of the eyelid and descends to, and behind, the tympanum where it terminates; numerous sepia-brown, or black, light-edged spots on the jaws, sides of head, body and limbs. Below, throat plumbeus faintly marbled with white, the margins of the jaws flecked with pure white; rest of underparts greenish-yellow, tinged with orange on belly and groins; breast and sides of belly vermiculated with brown and white.

Measurements. The largest frog, a female from the Nkuka Forest, measures 32 mm.

Breeding. None of the specimens taken in March appear to be breeding.

Diet. The food is generally too finely masticated to be recognisable, this was the case with seven frogs examined; in an eighth a bug, caterpillar and numerous small forest cockroaches were distinguishable.

Enemies. A frog (*Arthroleptis reichei*) was recovered from the stomach of a *Chlorophis neglectus* at Kigogo, and another from a *Crotaphopeltis h. tornieri* at Madehani.

Habitat. One of the Madehani frogs was taken in a small patch of swampy ground caused by seepage from the mountain side; wild bananas were abundant in this damp spot. The Kigogo frog was in rain forest near the Ruaha River. As already indicated the Ngosi frogs were taken in wild bananas. Though these bananas were abundant in the ravines of the Nkuka Forest, we found no frogs in them, all our large series being taken on the leaf-strewn forest floor. They are extremely quick to take cover, usually two hops and they have vanished, having slipped under the leaves or into the rotting vegetation, nor are they easily found once they have gained such a retreat. The species appears to be rare in its type locality but it should be remembered that only three days were spent on the Ngosi Volcano as against three weeks in the Nkuka Forest.

ARTHROLEPTIS SCHUBOTZI Nieden

Arthroleptis schubotzi Nieden, 1910, Sitzber. Ges. Naturf. Freunde Berlin, p. 440; and 1912, Wiss. Ergebn. Deutsch-Zentral-Afrika-Exped., **4**, p. 177, pl. v, fig. 3: Usumbura, Tanganyika Territory.

2 (M. C. Z. 17026–7) Dabaga, Uzungwe Mtns. 1. i. 30.
1 (M. C. Z. 17028) Kigogo, Uzungwe Mtns. 23. i. 30.
1 (M. C. Z. 17140) Madehani, Ukinga Mtns. 14. ii. 30.
349 (M. C. Z. 17029–53) Nkuka Forest, Rungwe Mtn. iii. 30.

Distribution. Only known from the holotype and five other specimens recorded by Nieden from Mpwapwa and Tukuyu. The frogs from Bagilo, Uluguru Mountains recorded under this name (Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 213) appear to be only color variants of *A. xenodactylus* Boulenger.

Native name. Koti (Kinyakusa, but not specific).

Affinities. Distinguished from its nearest East African allies by its very short hind limb, the tarso-metatarsal joint only reaching the eye in the type and in most specimens; in a very few individuals the tibio-tarsal articulation may reach the eye.

Coloration in life. Madehani. ♀. Above, bluish-grey mottled with black, the specks being more or less arranged in longitudinal lines on the back; thighs showing some light (blood) red, otherwise limbs colored as back. Below, very pale bluish-white heavily marbled with darker, the reverse is the case on the limbs which are mainly dark with a few pale bluish specks; groin and a few patches on the tibia red.

Measurements. The largest specimens, females, from Kigogo, Madehani and the Nkuku Forest all measure 18 mm.

Breeding. Undoubtedly breeding at Dabaga, Kigogo and Madehani where females, distended with eggs, were taken in swampy ground. At Madehani this was caused by seepage from the mountain side about fifty yards below the forest edge. In the same patch which was not more than five feet in diameter, two males and a female *A. parvulus* were taken together with a number of freshly hatched tadpoles still in the jelly. It is presumed that these were the larvae of *parvulus*. As about 300 of the Rungwe series consist of small young not as big as a house fly, it may be confidently assumed that the breeding season there coincides with that of the Uzungwe and Ukinga Mountains.

Diet. A tick, a muscid fly, termites, ants and very small maggots were recognisable. The food of a frog, itself scarcely larger than a bluebottle, must necessarily be very small.

Parasites. Rungwe frogs were commonly parasitised by a pink larval mite.

Habitat. The Dabaga pair were taken six feet from the bank of a brook, *A. minutus* was present close by but in more marshy ground. The nearest surviving forest was several hundred yards away. I have

little doubt that *schubotzi* is common in the big forest where *Colobus gordonorum* occurs for I have recollections of seeing it on the sole occasion when I visited this forest in search of guerezas.

The Kigogo frog was brought to me by Mr. H. Frazer who had found it in the forest nurseries abutting on a very small patch of rain forest.

The first examples from Rungwe were five young, ranging from 8 to 13 mm. in length, which I found among scraps of bark and chips from a felled tree in a clearing in the rain forest. Search revealed that the species was abundant, particularly in the numerous saw-pits scattered through the forest, these pits served as traps and from them the larger proportion of the series was obtained.

Arthroleptis xenodactylus Boulenger

Arthroleptis xenodactylus Boulenger, 1909, Ann. Mag. Nat. Hist. (8), **4**, p. 496: Amani, Usambara Mountains, Tanganyika Territory; Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 214: Uluguru and Usambara Mtns., Tanganyika Territory.

Arthroleptis schubotzi Barbour & Loveridge (*nec.* Nieden), 1928, Mem. Mus. Comp. Zoöl., **50**, p. 213: Bagilo, Uluguru Mtns., Tanganyika Territory.

81 (M. C. Z. 16976–17000) Mpwapwa, Ugogo. 22. xi. 29.
82 (M. C. Z. 17001–17025) Kitungulu, Urungu. 14. v. 30.

Distribution. Known from the above localities and Kilosa.

Variation. Compared with the topotype series in the Museum of Comparative Zoölogy with which they agree in possessing a single metatarsal tubercle, dilated finger tips and limbs of moderate length.

Coloration in life. Extraordinary variation was to be seen in the Kitungulu series among which I noted the following principal types:

(i) Above, brown tinged with pink, the whole upper surface exhibiting a metallic gloss; a yellowish vertebral line from the snout to a point just above the anus where it forks, almost at right angles, to terminate on the inner side of the knees; a dark triangular mark between the eyes, its apex passing backwards and merging into two similar, but diamond-shaped, blotches, the whole forming the chain of markings characteristic of many members of the genus; a light line from the snout passes above the eye where it ceases, below it is a darker line extending backwards as far as the tympanum. Below, colorless except the belly which is cream and the throat and flanks which are marbled with grey; the hinder aspect of the thighs is profusely sprinkled with fine white spots.

(ii) Above, bright red or reddish-brown, the vertebral line red; no

transverse line across the anal-thigh region; no light line from the nostril over the eye; otherwise the markings are as in (i).

(iii) Above, bright yellowish-green, almost uniform, such markings as are present are so faint as to be indiscernible except upon close scrutiny with a lens. Below, exactly as in (i).

Measurements. The largest frogs, females from Mpwapwa, measure 21 mm., the largest from Kitungulu are 18 mm.

Parasites. A female Oxyuroid worm was present in one frog examined.

Enemies. A frog of this species was found in the stomach of each of four young White-lipped Snakes (*Crotaphopeltis h. hotambocia*) taken at Kitungulu.

Habitat. The habitat is similar to that which I have recorded at Amani, viz. among an abundance of fallen leaves beneath trees. At both Mpwapwa and Kitungulu there was a stream in close proximity to the leaf-strewn ground upon which these frogs were found. At Kitungulu the leaves had resulted from the felling of primary forest for native gardens; the frogs were also found in cavities in the rotting logs which were lying about.

ARTHROLEPTIS MOORII Boulenger

Arthroleptis moorii Boulenger, 1898, Proc. Zoöl. Soc. London, p. 479, pl. xxxviii, fig. 2: Kinyamkolo, Lake Tanganyika.

14 (M. C. Z. 17127–36) Nyamkolo, Lake Tanganyika. 9. v. 30.

Distribution. This little frog is, I believe, still only known from the type of which the present series are topotypes for the prefix "Ki" in the local dialect is an augmentative, in direct contrast to its use as a diminutive in Swahili. Niomkolo is another rendering of the name of this same village which is situated on the southeast shore of Lake Tanganyika in Northern Rhodesia.

Variation. I should consider the nostril equidistant from the eye and end of snout; while the first and second finger are sometimes of equal length, in some specimens the first is very definitely shorter than the second; the tips of the digits are not swollen; the tibio-tarsal articulation, while generally only reaching the eye or nostril, does sometimes reach the end of the snout as in the type.

Coloration in life. The pattern is exactly like that of the holotype in some specimens, in others there is a narrow vertebral stripe. Above, a pale ashy-grey or grey-brown with blotches and bars in sepia; the interorbital mark mentioned by Boulenger is more four-sided in the

present series, both the elongate lateral and the shorter posterior edges being concave in outline and the four corners produced into points and heavily pigmented; lips speckled with white. Below, white, the throat flecked with dusky, this pigmentation may be so concentrated in males as to give the impression of a grey throat.

Measurements. The largest is a male measuring 17 mm., there are no adult females.

Breeding. The high proportion of very young frogs is evidence that the breeding season is past; the rains had ended in March.

Habitat. By reason of their small size these frogs are exceedingly difficult to find. The whole series was taken in the dew-laden short grass about the centre of the bay immediately below the residential buildings of the mission. If one of these frogs is disturbed it takes but one hop then dives in among the roots of the grass where it remains motionless. The collecting of this series represents several hours of concentrated search whereas if Nyamkolo had only been visited at the beginning of the breeding season when presumably *moorii* would be congregating in pools it is probable that an adequate series might have been obtained with ease.

Arthroleptis minutus Boulenger

Arthroleptis minutus Boulenger, 1895, Proc. Zoöl. Soc. London, p. 539: Durro, western Somaliland; Loveridge, 1929, U. S. Nat. Mus. Bull. No. 151, p. 107: Localities in Uganda, Kenya and Rhodesia.

9 (M. C. Z. 17051–9) Bagamoyo. 12. xi. 29.
80 (M. C. Z. 17060–3) Dabaga, Uzungwe Mtns. 1. i. 30.
49 (M. C. Z. 17064–74) Kigogo, Uzungwe Mtns. 13. i. 30.
1 (M. C. Z. 17075) Mwaya, Lake Nyasa. 1–8, iii. 30.
4 (M. C. Z. 17080–3) Kipili, Lake Tanganyika. 19. v. 30.
5 (M. C. Z. 17084–8) Albertville, Lake Tanganyika. 21. v. 30.
2 (M. C. Z. 17089–90) Entebbe, Lake Victoria. 27. vi. 30.

Native name. Kasambara (Kinyakusa).

Coloration in life. When at Dabaga, I had not realised that the two types referred to in the following note were two species, the larger *minutus,* the smaller *parvulus.* The note reads:—"There seem to be two types of males, a larger, which is lemon-yellow on the belly, bright yellow on the throat, and a smaller which has a white, or bluish-white belly mottled with black and a black throat, is it possible that the latter are immature for their throats only show a bagginess while the yellow-throated males have a definite disk." Unfortunately in alcohol the whole Dabaga series of males are uniformly white below.

On reaching Kigogo I found the two species occupying separate breeding areas and so recognized the two species. The color of Kigogo frogs of the species *minutus* was: ♂. Throat bright chrome, lemon-yellow or whitish on the belly with very few specklings and such as there are, are lateral. ♀. Below, white or silvery-white, specklings when present are also lateral as in the males.

Measurements. The largest male is 18 mm.; the largest female 22 mm.; the smallest frogs are 9 mm.

Breeding. Undoubtedly assembling to breed at both Dabaga and Kigogo. At the former locality the series consisted of 64 males and 16 females, at the latter 20 males and 28 females; these females, as is also one from Entebbe, are distended with ova except a few at Kigogo which appeared to have laid.

The Kipili and Albertville frogs are very young and identified with doubt as they may well be referable to *parvulus;* those from Kipili measure 13 to 14 mm. in length while the range of the Albertville series is 9 to 11 mm.

Call note. The call of *minutus* is very like the rattling call of *Phrynobatrachus acridoides,* but ends in a click; it is, of course, much fainter.

Parasites. The chigger mites which I mentioned in 1929 (loc. cit.) have since been described as *Endotrombicula penetrans* by Dr. H. E. Ewing.

Enemies. At Mwaya, one was taken from an Olive Water Snake (*Natrix olivaceus*) and another from a Hissing Sand Snake (*Psammophis sibilans*).

Habitat. The Bagamoyo frogs were found in a swamped *mbugwe* three miles out along the Dar es Salaam road and by waterholes near the seashore. This frog does not like the water but may be found in damp grass or on mud in the vicinity of water holes. Those from Dabaga were taken in cattle-trampled bog land bordering a swiftly-flowing brook in the bottom of a valley.

Arthroleptis ukingensis Loveridge

Arthroleptis ukingensis Loveridge, 1932, Bull. Mus. Comp. Zoöl., **72**, p. 385: Madehani, Ukinga Mtns., southwestern Tanganyika Territory.

3 (M. C. Z. 17137–9) Madehani, Ukinga Mtns. 14. ii. 30.
3 (M. C. Z. 17076–8) Ilolo, Rungwe district. 15. iii. 30.

Remarks. As stated in the diagnosis, this frog is near *A minutus* Boulenger from which it is distinguished by very well developed digital expansions. In *Phrynobatrachus acridoides* there is wide variation in

this character but there are no expansions in any of the *minutus* which I have collected in East Africa over a long period.

It agrees closely with De Witte's description of *A. boulengeri* from the St. Louis Plain at the edge of Lake Tanganyika excepting that *boulengeri* lacks an outer metatarsal tubercle as well as a tarsal tubercle.

Ahl has described a related form from Buala in the Cameroons as *A. pygmaeus* but the Madehani frogs differ from his description of the 14 mm. holotype in possessing a lingual papilla; in the snout being longer than the eye diameter; the 3rd finger being as long as the snout; the tibio-tarsal articulation reaching the eye and minor differences so that it is improbable that they are specifically identical.

Mr. H. W. Parker has examined the Madehani series which he considers conspecific with the frogs from Kibonoto referred by Lönnberg to "*A. bottegi*" which he feels sure is an incorrect indentification. He adds that after comparing the Kibonoto frogs and 17137–9 with the type of *minutus* " I can only find a most trivial difference in the tarsal tubercle. In the type it is more a triangular flap-like, continuation of the tarsal fold, whereas in the others it is a conical papilla."

I quite agree that little importance can be attached to the appearance of the tarsal tubercle for wide variation occurs in its development in our large series of *minutus*. On geographical grounds I should imagine the Kibonoto frogs to be referable to *minutus*.

Breeding. The type was taken in embrace with a male in a small patch of swamped ground close to some wild bananas growing on the mountain side without the forest. Beside them was some jelly, containing tadpoles, which was plastered over leaves and twigs; it would have been almost impossible to find clear water at this spot.

Parasites. Ilolo frogs have minute dermal parasites on the skin of the belly.

Arthroleptis rungwensis Loveridge

Arthroleptis rungwensis Loveridge, 1932, Bull. Mus. Comp. Zoöl., **72**, p. 386: Ilolo, Rungwe Mtn., southwestern Tanganyika Territory.

♀ Type (M. C. Z. 17141) Ilolo, Rungwe Mtn. 15. iii. 30.

The complete discussion about this frog appears in the citation given above.

Arthroleptis parvulus Boulenger

Arthroleptis parvulus Boulenger, 1905, Ann. Mag. Nat. Hist. (7), **16**, p. 109, pl. iv, figs. 3–3b: Bange Ngola northeast Angola.

2 (M. C. Z. 17091–2) Dabaga, Uzungwe Mtns. 1. i. 30.
70 (M. C. Z. 17093–100) Kigogo, Uzungwe Mtns. 24. i. 30.
5 (M. C. Z. 17101–5) Lukungu, Ubena Mtns. 8. ii. 30.
1 (M. C. Z. 17106) Mangoto, Ukinga Mtns. 10. ii. 30.
11 (M. C. Z. 17107–16) Tandala, Ukinga Mtns. 11. ii. 30.
1 (M. C. Z. 17117) Bulongwa, Ukinga Mtns. 12. ii. 30.
Tadpoles & 8 (M. C. Z. 17118–26) Madehani, Ukinga Mtns. 14–19. ii. 30.

Distribution. This species is new to Tanganyika Territory being known only from northeast Angola and the southern Belgian Congo.

Native name. Bungulula (Kikinga).

Affinities. So closely related is this species to *A. minutus* that I can find no characters, other than size and breeding coloration and call notes, to distinguish them. As already related, both species are to be found in the same swamp at Dabaga, but at Kigogo they occupied different valleys and the difference in the calls was very plain. It may be that some *parvulus* are still included in the big series of *minutus* from Dabaga, but the Kigogo specimens were sorted in the field and retain their characteristic ventral pigmentation.

Variation. They agree closely with the description of the types.

Measurements. The largest of sixty males in the Kigogo series measured 15 mm., the largest of the ten females in the same series measure 18 mm., these were measured in the field. The rest of the series consists of fifteen males ranging from 13 to 16 mm., with an average of 14 mm., seven females ranging from 13 to 17 mm. with an average of 15 mm. and two young, 8 and 10 mm. in length.

Breeding. Three pairs were taken in embrace at Kigogo where the swamps resounded with their vibrant trilling calls and the males outnumbered the females by six to one. Three weeks later a pair was taken at Madehani together with a young one of 8 mm. The tadpoles taken at the same time may be those of *schubotzi* which was found in the same swamp.

Habitat. Most of the Kigogo series were found in a peaty drainage area where there were a few small catchments of water. The surrounding ground was so damp as to well up with moisture at every footstep. Such a situation was wholly typical of their haunts in the ravines and shallow valleys of these uplands. Five were taken at Lukungu in as many different swamps but *A. minutus* was neither heard nor seen. I noted that *parvulus* was present in all the swamps and streams along the trail to Mangoto.

Hemisus marmoratum marmoratum (Peters)

Engystoma marmoratum Peters, 1855, Arch. Naturg., **21**, part 1, p. 58; Cabaçeira, Mozambique.

Hemisus marmoratum Nieden, (part), 1926, Das Tierrich, Anura **2**, **49**, p. 11: Wager, 1929, Trans. Roy. Soc. S. Africa, **17**, pp. 127–135, text figs. 1–5, plates viii–x.

Eggs, tadpoles and 11 (M. C. Z. 16455–67) Bagamoyo. 13. xi. 29.

Distribution. Nieden has recorded this race from Mwanza. In addition to the Bagamoyo specimens listed above, I have utilized eleven other examples from Tanganyika Territory which are in the collection of the Museum of Comparative Zoölogy. They are from Gonya, Tanga, Dar es Salaam, Morogoro, Kilosa, Uliya, and Sagayo in Mwanza district.

Affinities. De Villiers considers *Hemisus* a ranid, rather than a brevicipitid, but Noble prefers to continue its inclusion in the Brevicipitidae. Parker, however, agrees with De Villiers. The reason for employing trinomials is explained under *H. m. guineensis* Cope.

Measurements. Nine males measure from 24 to 27 mm.
Nine females " " 27 to 33 mm.
Four young " " 17 to 23 mm.

The snout is contained in the total length from 6 to 8 times.
" tibia " " " " " " " 2.2 to 2.7 times.
" foot " " " " " " " 1.4 to 1.7 times.

Breeding. Bagamoyo is so dry that the natives set their banana plants in hollows when possible. Digging at the roots of these bananas we discovered a female with her eggs just two inches below the surface of the sand, six inches away was a male. At the base of a second banana another female was discovered resting on a mass of jelly or slime in which tadpoles were actively moving. The mucous or gelatinous substance was intermixed with sand and though I carefully transferred the whole mass to a tin, by the time camp was reached nothing but tadpoles and sand remained. The tadpoles were picked out and a hundred and ten recovered, evidently *Hemisus* deposits a large number of eggs at one time. The nearest male found by the spot where these tadpoles were discovered was six feet away. The interesting breeding habit of *Hemisus* has long been known. As an inhabitant of sandy, and sometimes desert regions, the advantages to it of a method which dispenses with surface water during the early stages of development are obvious. There was no water in the hollow at this time and, owing to the sandy terrain, it is doubtful if water would be

retained for more than a few hours after a rainstorm. For a detailed account of the interesting nesting habits of this creature, see Wager's paper cited above.

Diet. Termites in those examined.

Hemisus marmoratum guineensis Cope

Hemisus guineensis Cope, 1865, Nat. Hist. Review, p. 100, footnote: presumably Guinea (Type in the Vienna Museum).

Hemisus marmoratum Noble, part, 1924, Bull. Am. Mus. Nat. Hist., **49**, p. 279: Niangara, Faradje and Zambi, Belgian Congo.

4 (M. C. Z. 16468–71) Masiliwa, Turu. 9. xii. 29.
1 (M. C. Z. 16472) Mangasini, Usandawi. 14. xii. 29.

Variation. Coming fresh from collecting a series of breeding females and eggs of *H. m. marmoratum* at Bagamoyo where none exceeded 33 mm. in length from snout to anus, I was astonished to find at Masiliwa females measuring 32, 44, 45 and 49 mm. respectively.

Consulting Noble's most useful report on the variation which he observed in ninety-six specimens from the Congo, I observe that he states, "Gravid females average 47 mm. (maximum 50 mm.; minimum 45 mm.)." This caused me to measure the four West African (Belgian Congo, Nigeria and Liberia) specimens in our collection and found that the West African frogs are much larger than typical *marmoratum* from the east coast, and may be separated by the number of times the length of the foot is contained in the length from snout to anus. Parker informs me that of a pair from Pako, Ituri, Belgian Congo, the ♂ measures 35 mm., the female 52 mm.

In looking for the name which should be employed, I cannot use *H. sudanense* (Steindachner) for not only is it of the same dimensions as *marmoratum* but our single example from Kordofan bears out the author's remarks and I think that it may be safely considered as a subspecies, viz. *H. m. sudanense* (Steindachner) distinguished from the typical form by its longer and more shovel-shaped snout; it certainly differs in these characters from the thirty-one members of the genus in the Museum of Comparative Zoölogy.

E. guineense, a m.s.s. name attributed to Sir A. Smith by Günther in 1858 (Cat. Batr. Sal. Brit. Mus., pp. 47 and 137) is devoid of description but Cope's footnote (1865) validates the name for he refers to certain anatomical characters of a specimen in the Vienna Museum. Cope therefore becomes the author. The two forms may be differentiated thus:

Foot contained in length from snout to anus 1.4 to 1.7 times; adult males 24 to 27 mm., adult females 27 to 33 mm. . . . . *m. marmoratus*
Foot contained in length from snout to anus 1.7 to 1.9 times; adult males 31 to 36 mm., adult females 32 to 52 mm. . . . . *m. guineensis*

Measurements. One male measures 36 mm. (Noble's series 31 to 34 mm.) Six females measure 32 to 49 mm. (Noble's series 45 to 50 mm.)

The snout is contained in the total length from 7.3 to 8.8 times.
" tibia " " " " " " " 2.2 to 2.8 times.
" foot " " " " " " " 1.7 to 1.9 times.

Coloration in life. Handsomely spotted and streaked with pale yellow.

Habitat. The Masiliwa specimens were taken during a shower at 9 p.m. as they were hopping about on recently hoed ground as described in detail under *Rana delalandii.*

POLYPEDATIDAE

Chiromantis petersii petersii Boulenger

Chiromantis petersii Boulenger, 1882, Cat. Batr. Sal. Brit. Mus., p. 93, pl. x, figs. 1–1a: "Interior of East Africa," i.e. Mpwapwa, Ugogo, Tanganyika Territory; Loveridge, 1929, U. S. Nat. Mus. Bull. 151, p. 119: Localities in Tanganyika Territory.

Chiromantis pygmaeus Ahl, 1930, Zoöl. Anz., Berlin, **88**, p. 219: Kibwezi, Kenya Colony.

Chiromantis pictus Ahl, 1931, Sitz. Ges. Naturf. Freunde Berlin, p. 213: Kilimatinde, Tanganyika Territory.

Chiromantis rugosus Ahl, 1931, Sitz. Ges. Naturf. Freunde Berlin, p. 215: Langenburg (i.e. Manda), Lake Nyasa, Tanganyika Territory.

1 (M. C. Z. 16735) Kilimatinde, Ugogo. 27. xi. 29.
1 (M. C. Z. 16736) Unyanganyi, Turu. 6. xii. 29.
10 (M. C. Z. 16737–46) Handa, Usandawi. 10. xii. 29.
Nest, eggs, tadpoles & 32 (M. C. Z. 16747–59) Mangasini, Usandawi. 13–14. xii. 29.
7 (M. C. Z. 16760–6) Shinyanga, Usukuma. 3. vi. 30.

Variation. The Mangasini series alone cover all the variations for which Ahl proposed the names *albescens* and *fasciatus* in 1929 and confirm the view that all these alleged "species" are synonyms of *petersii.* The tibia is included from twice (M. C. Z. 16750. ♂) to two and a half times (M. C. Z. 16754. ♀) in the length from snout to anus. I was,

however, in error in synonymising *macrops* with typical *petersii;* it should be referred to the synonymy of *C. petersii kelleri* Boettger.

More recently Dr. Ahl has proposed three more names based on trivial variations which it is not necessary to discuss. It will be observed that M. C. Z. 16735 is a topotype of *pictus* and it might be pointed out that Kilimatinde is only a hundred miles from the type locality of *petersii*, that the official altitudes are 3,591 feet for Kilimatinde and 3,312 feet for Mpwapwa and that both are in the same continuous stretch of thorn-bush steppe with apparently identical ecological conditions. On topographical grounds more material may demonstrate *rugosus* to be a southern form of *petersii.*

Coloration. The usual hue of this frog may be said to be clay-colored. Such a frog found squatting in the direct rays of the sun at 9.30 a.m. was placed in a white bag where it remained for twenty-four hours; on removal it was found to be a wood-brown shade. Breeding males are distinguishable by their throats being plumbeous colored.

Measurements. Omitting the Shinyanga series which range from 35 to 42 mm., twenty males range from 41 to 49 mm., with an average of 45 mm.; twenty-seven females range from 46 to 65 mm. with an average of 56 mm.

Breeding. The Kilimatinde and Unyanganyi females are full of ova. At Handa nine frogs were found squatting on thorn-bush twigs around a water hole and one on the bare ground near a shallow pool. It was interesting to note that though there were shady, leafy posts around these water holes the frogs preferred to squat on the bare, dead, thorn bush employed to reinforce the stockade and which was in the full glare of a sun that seemed exceptionally hot.

Eight nests were found around these water holes, either in the fresh green grass of which there were one or two patches, or in niches of the rough earth banks, or simply on mud at the water's edge. Five nests were seen on the mud round a shallow rain pool out on the *mbugwe* (black cotton soil plains with scattered bull's-horn acacia); these were all more or less trampled into the mud and destroyed by game coming down to drink. Seventeen nests were counted on the mud surrounding one large pool in the bottom of a ravine that would be the bed of a great river during the rainy season. In none of these sites were there bushes within five feet of the water's edge, the eggs were yellow spheres and evidently very recently deposited.

At Mangasini, on December 13th, I found twenty-five of these frogs on thorn bush and scrubs in the vicinity of a water hole. The females were distended with ova. Thirty feet from the water none were to be

found. Presumably they had congregated as a result of the eighteen hours continuous downpour with which the rainy season started yesterday, the shower only terminating at noon today (13th). At 8 p.m. I went down in bright moonlight but could find no frogs in the water and only a little desultory calling was proceeding from the thorn bush fence surrounding the water hole. The call is a "wock-wock" sometimes prolonged with a whirr. During the night these frogs spawned on the mud surrounding a pan of water which I had put in a temporary vivarium.

Next morning (14th) I took seven frogs in a large shallow pool in the swamped *mbugwe* and we found two nests in tussocks of grass growing from the water. On one of these nests a female still sat, vigorously but mechanically working up the foam with her hind legs, her left hand rested in a fork of the reedy grass and her right hand grasped some grass with the fingers all in one plane. She was six inches above the surface of the water, this measurement corresponded to the height of the nest. It was observed that fresh foam is pure white and assumes its creamy tint only on drying, it is very glutinous when fresh and this stickiness affords an excellent protection from insects, for one or two were seen trying to free themselves having inadvertently alighted upon it. I have seen beetles run freely over a dry nest.

On December 17th, when twenty miles north of Saranda, I found quite fifty nests around a very large pool, all laid on the mud though branches were available. Some nests appeared to be the work of several frogs for they would easily have filled an ordinary washing basin. Two frogs were seen but not collected. On the 18th, at Saranda, several nests were found on the trampled edges of a pool. It is difficult to see much survival value in the unintelligent method of depositing eggs as practiced by Peter's Frog in the semi-arid thorn-bush country; great numbers of nests are destroyed by the hooves of game or cattle and myriads of tadpoles perish by stranding on the mud.

Aestivating? The countryside was already becoming parched on June 3rd when we discovered five frogs among the twigs forming the basal part of a crow's nest at Shinyanga. The nest was situated thirty feet from the ground in the bare branches of a baobab tree growing in open country. These toads were all of small size being 35 to 39 mm. in length. Dissection of two showed their stomachs to be empty and quantities of bright yellow fat were present, though lacking in the breeding frogs taken elsewhere. The rains had ceased a month before, the weather was already very hot, and it seemed probable that the frogs were aestivating.

Habitat. A search of Manyara hedges at Dodoma in mid-November

failed to discover any of these frogs. At Kilimatinde I examined nearly a mile of hedge before securing one.

Leptopelis bocagii (Günther)

Cystignathus bocagii Günther, 1864, Proc. Zoöl. Soc. London, p. 481, pl. xxxiii, fig. 2: Duque de Bragança, Angola.

Hylambates marginatus Bocage, 1895, Herpétologie D'Angola, p. 178: Quissange, interior of Benguella, Angola.

Leptopelis bocagii Loveridge, 1929, U. S. Nat. Mus. Bull. 151, p. 121: Ulukenya Hills, Kenya Colony.

Hylambates brevipalmatus Ahl, 1930, Zoöl. Anz., **87**, p. 228: Unyika, Tanganyika Territory.

2 (M. C. Z. 16767–8) Masiliwa, Turu. 19. xii. 29.
1 (M. C. Z. 16769) Senjeri Pass, s. of Unyika. 5. v. 30.

Affinities. The specimen from Senjeri Pass is almost topotypic of Ahl's *H. brevipalmatus* from the description of which it differs in the hind foot being included 1.64 times in the length from snout to anus which is 2.5 times in *brevipalmatus* according to Ahl. A request for information on this point was not favored with a reply. More recently, at my suggestion, Mr. K. P. Schmidt kindly reëxamined the type and remeasured it so that I find that the length of the foot is really included 1.61 times in the body length. Mr. Schmidt's measurements of the type of *brevipalmatus* are: Length from tip of toe to heel 25.5 mm. Length of longest toe from its tip to the posterior edge of the large metatarsal tubercle 18 mm. Finally Mr. Schmidt states that the shoulder girdle of the type, though somewhat mangled, is that of Leptopelis and not of Hylambates. He concurs in synonymising it with *bocagii*.

Boulenger (1906, Ann. Mus. Civ. Stor. Nat. Gen. (3), **2**, (**42**), p. 10) remarks that *H. marginatus* Bocage, which was only known to him from the description, "appears to differ in the longer toes (foot more than half the length of head and body); if one works out the proportions given by Bocage (**1**. *c*. pp. 176–180) it will be seen that this assumption was incorrect for *H. marginatus* is 1.80 times in the length and the other species already referred to the synonymy of *bocagii* by Boulenger after "careful comparison" of the types and "a large series of specimens" are *H. bocagii*, 1.53 times, *H. cinnamomeus* Bocage, 1.44 times, *H. anchietae* Bocage, 1.96 times. Thus the feet of the types of these Angolan specimens range from 1.44 to 1.96 times in the length from snout to anus. As a check the series of eight specimens in the Museum of Comparative Zoölogy have been measured and found to

range from 1.43 times (Faradje, Belgian Congo) to 1.75 times (Guaso Nyiro, Kenya Colony); the Tanganyika series alone from 1.52 to 1.64 times.

Variation. The tibio-tarsal articulation falls short of the tympanum but the metatarsal articulation marks the eye; the interorbital space equals the width of an upper eyelid.

Coloration. All possess the characteristic dark dorsal patch, but posteriorly the patch tends to break up.

Measurements. These three males range from 45 to 52 mm.

Diet. The Masiliwa frogs taken at 8 a.m., held fourteen long termites, a beetle, earwig, spider and centipede. The Senjeri frog, on the other hand, taken by a roadside ditch at 11 p.m., had an empty stomach but was loaded with fat which was lacking in the Masiliwa frogs.

Enemies. The Masiliwa frogs were taken from the mouth and stomach of a Boomslang (*Dispholidus typus*) which I captured in the act of swallowing one of them.

Leptopelis johnstoni (Boulenger)

Hylambates johnstoni Boulenger, 1897, Proc. Zoöl. Soc. London, p. 803, pl. xlvi: Kondowe to Karonga & Nyika Plateau, Nyasaland. Lönnberg, 1907, Reptilia and Batrachia in Sjöstedt, 1910 Kilimandjaro-Meru Exped., **1**, part 4, p. 25: Mombo, Usambara, Tanganyika Territory.

Leptopelis johnstoni Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 239: Bagilo, Uluguru Mtns., Tanganyika Territory.

2 (M. C. Z. 16770–1) Mwaya, Lake Nyasa. 1. iii. 30.
1 (M. C. Z. 16772) Ilolo, Rungwe district. 8. iv. 30.

Distribution. Mwaya is only a few miles north of Karonga and Ilolo is practically on the Nyika Plateau so that these specimens are almost topotypes.

Affinities. These frogs agree with *vermiculatus* from the nearby forest in their strongly compressed tubercle and in the interorbital width being the same as an upper eyelid but differ in vomerine teeth, smaller disks, less extensive webbing of the hind feet and coloration.

Variation. The tibiotarsal articulation reaches the eye in the Mwaya frogs (♂, ♀) but falls short in the Ilolo specimen (♀).

Coloration in life. Agrees with that described for the Uluguru specimens.

Measurements. The male is 42 mm., the large female 62 mm.

Breeding. The Mwaya female holds a mass of eggs, each about 2.5 mm. in diameter; the Ilolo frog seems to have spawned quite recently.

Diet. A very large snail was taken from the Ilolo frog's stomach.
Habitat. All were taken in domestic bananas.

Leptopelis vermiculatus (Boulenger)

Hylambates vermiculatus Boulenger, 1909, Ann. Mag. Nat. Hist. (8), **4**, p. 497: Amani, Usambara Mountains, Tanganyika Territory.
Leptopelis signifer Ahl, 1929, Sitzber. Ges. Naturf. Freunde Berlin, p. 216: Amani, Derema, etc., Usambara Mountains, Tanganyika Territory.

2 (M. C. Z. 16773–4) Nkuka Forest, Rungwe Mtn. 9. iv. 30.

Distribution. Nieden referred two young frogs from Uhehe to this species which is very closely related to *rufus*.

Affinities. In an attempted revision of the genus Leptopelis, of which less than a dozen species were known in 1928, Dr. Ahl has described no fewer than twenty-one additional species. It is obvious that Dr. Ahl's conception of what constitutes a species differs widely from that of his predecessor Dr. F. Nieden, for the types of fourteen of these "species" had been identified previously with *rufus* by Nieden. It is also interesting to note that Amani or the Usambara Mountains is type locality for six of these species.

The key which is supposed to enable one to distinguish these species is almost entirely useless in practice, being based on the most trivial differences long known to vary with age and sex. It is perfectly easy to take a series of frogs from one locality like Bagilo in the Uluguru Mountains and on applying the key find that they break up into several species or land in deadlocks. It is not surprising therefore to find that eleven of these new "species" were based on single frogs.

When describing *L. signifer* Dr. Ahl designates three Derema specimens as "Type" (presumably meaning cotypes) and regards fifteen others as "Cotypes" (i.e. paratypes). Derema is scarcely two miles from Amani. A Derema cotype of *signifer* (M. C. Z. 17530) has been compared with an Amani topotype of *vermiculatus* (M. C. Z. 13598) which in its turn had been compared with the type in the British Museum. There seems to be no reason for supposing that *signifer* is anything but a strict synonym and one wonders how it came to be described.

Coloration in life. Above, purplish-brown but the whole of the centre of the back is occupied by an arrow-head marking as in *L. johnstoni*, the apex reaching nearly to the occiput; this marking is a rich olive green bordered by black; there are three patches of the same color on the lips, the last prolonged posteriorly over the tympanum nearly to

midbody; two large, rather brighter blotches further back on the flank, the hindmost extending upwards to coalesce with the arrow-head marking above the groin; all these markings are edged with black; the fore and hind limbs are green, barred with darker; there are five cream colored spots on the upper lip of which the middle one extends upwards to merge into the brown of the head; the disks of the two innermost fingers are cream colored. Below, cream and pure white marbled with purplish and greenish-brown, the abdomen tinged with ochre; a rather ill-defined cream-colored streak along the underside of the hind limb and outer edge of the foot; no markings on anus or heel.

Measurements. The adult female measures 65 mm., immature female 55 mm.

Breeding. The ovaries of the larger frog hold developing ova.

Parasites. There are minute, pink, larval mites embedded in the skin of the feet.

Habitat. When forced by a downpour to take refuge in a saw-pit which was roofed over, I discovered the female adult snugly ensconced in a little depression beneath the drift of dead leaves which covered part of the floor. The leaves were mostly brown or black so that the brilliant coloring of the frog was not a little astonishing.

LEPTOPELIS AUBRYI (A. Duméril)

Hyla aubryi A. Duméril, 1856, Rev. Mag. Zoöl. (2), **8**, p. 561: Gaboon.

Leptopelis tessmanni Noble (*nec.* Nieden), 1924, Bull. Am. Mus. Nat. Hist., **49**, p. 245: Medje, Belgian Congo.

Leptopelis aubryi Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 233: Mt. Lutindi, Usambara Mtns., Tanganyika Territory.

Leptopelis barbouri Ahl, 1929, Sitzber. Ges. Naturf. Freunde Berlin, p. 199: Mt. Lutindi, Usambara Mtns., Tanganyika Territory.

Affinities. Two of the series of Medje frogs referred to *tessmanni* by Dr. G. K. Noble are now in the Museum of Comparative Zoölogy and I consider are indistinguishable from our series of Cameroon *L. aubryi*.

In 1928, when Dr. T. Barbour and I referred certain frogs from Mt. Lutindi to *L. aubryi* we drew attention to the fact that the tympana were lacking or concealed in the nine young while those of the adults, or semi-adults, which were taken within fifty feet of the young, were three-quarters and seven-eighths the diameter of the eye, instead of "half" as stated by Boulenger in 1882.

It was supposed that it would be apparent to most herpetologists that if the tympanum is concealed in the young, its proportions, at

various stages of development, in relation to the eye diameter must be radically different. This rather obvious inference apparently escaped Dr. Ahl who, without ever having examined them and on the basis of the four lines of comment which we made, designates these specimens as types of a new species which he calls *Leptopelis barbouri*.

I might add that Dr. Barbour is in entire agreement with my action in synonymising this name; we have had the somewhat unique advantage over the author in having seen the types and after careful comparison with a series of *L. aubryi* from the Cameroons, we fail to detect any structural differences which would warrant the assumption that we are dealing with two distinct species or recognisable geographical races.

Leptopelis uluguruensis Barbour & Loveridge

Leptopelis uluguruensis Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 235, pl. iii, fig. 3: Nyange, Uluguru Mountains, Tanganyika Territory.

Leptopelis tanganus Ahl, 1929, Sitzber. Ges. Naturf. Freunde Berlin, p. 221: Amani, Buloa (i.e. Bulwa), and Tanga, Tanganyika Territory.

Through the courtesy of Dr. Ernst Ahl a cotype of his *L. tanganus* has been received and carefully compared with the type series of *L. uluguruensis* from which it does not appear to differ.

Megalixalus fornasinii (Bianconi)

Euchnemis fornasinii Bianconi, 1850, Spec. Zoöl. Mosamb. Rept. pl. v, fig. 1: Mozambique.

Megalixalus fornasinii var. *unicolor* Boettger, 1913, in Voeltzkow, Reise in Ostafrika, p. 349: Pemba Island.

Megalixalus loveridgii Procter, 1920, Proc. Zoöl. Soc. London, p. 418: Morogoro Tanganyika Territory; Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, pp. 227–230: Many localities.

Megalixalus fornasinii Parker, 1930 (1931), Proc. Zoöl. Soc. London, pp. 900–902: Localities in Mozambique.

Megalixalus dorsimaculatus Ahl, 1930, Sitzber. Ges. Naturf. Freunde Berlin, p. 92: Magrotto near Tanga, Tanganyika Territory.

Hyperolius pygmaeus Ahl, 1931, Mitt. Zoöl. Mus. Berlin, **17**, p. 22: Tanga, Tanganyika Territory.

4 (M. C. Z. 16801–4) Bagamoyo. 16. xi. 29.
34 (M. C. Z. 16805–17) Morogoro, Ukami. 20. xi. 29.
7 (M. C. Z. 16818–25) Mwaya, Lake Nyasa. 1–8. iii. 30.

Distribution. Recorded from Bagamoyo, Ukami, Ukinga Mountains and Rungwe by Nieden.

Native name. Pasa (Kinyakusa).

Affinities. In 1930 Ahl attempted a revision of the genus *Megalixalus* with results that can only be characterized as deplorable for he recognized almost every species described, reviving *M. spinifrons* (Cope) and *M. stuhlmanni* Pfeffer which have long been recognized as strictly synonymous with *fornasinii*. No notice is taken of the transference of *Megalixalus gramineus* to *Leptopelis* by Parker, "*Hyperolius*" *fulvovittatus* Cope is omitted, etc. etc. *Hyperolius pygmaeus* appears to be based on a young male, the only specimen was 17 mm. An 18 mm. male (M. C. Z. 16805) in the present series agrees so closely structurally, disk and all, with Ahl's description as to make me certain they are synonymous. The white flecked, broad, brown lateral band is characteristic of Tanga specimens.

More recently, January 1931, Parker cleared up the tangle in which certain species of the genus have been since 1882 by showing that *M. dorsalis* (Peters) of West Africa is a valid species (it was recognized by Ahl as distinct as he considered nearly all names valid) long confused with *M. fornasinii* of which *M. loveridgii* is a straight synonym.

Variation. The spines of three Bagamoyo frogs were flush with the surface of the skin and had only the appearance of minute dots.

Coloration. Only one of the four Bagamoyo frogs had a mid-dorsal streak, the others were silvery-white soon changing to brown when put in a bag. The Morogoro series, topotypes of *loveridgii*, show the same variation, some having a dorsal streak like the type, others being uniform like our cotype of Boettger's *unicolor* from Pemba which that author recorded as occurring with *fornasinii* on the island.

I might add that when sending me this cotype of *unicolor* in 1929, Dr. Robert Mertens told me that he considered *fornasinii*, *unicolor* and *loveridgii* were all one species and that he imagined that the minute spines probably became more prominent during the breeding season. He was entirely correct.

Breeding. The presence of so many 15 mm. young at Morogoro, as described below, indicates that the breeding season was recently over in that locality, i.e. had taken place during the "big rains."

Enemies. At Mwaya a frog was recovered from the stomach of a Spotted Wood Snake (*Philothamnus s. dorsalis*).

Habitat. I took the first pair of Bagamoyo frogs in the central shoot of a domestic banana, a third was in a similar situation but the fourth came from sedges at the edge of a swamp. The species appeared dis-

tinctly scarce as several score of bananas were searched. At Morogoro, on the other hand, two males, sixteen females and sixteen young were taken in a small patch of bananas only two hundred yards from the station. As many as nine were taken beneath one leaf stalk though usually there were not so many. A larger series could have been obtained with ease.

Megalixalus brachynemis Boulenger

Megalixalus brachynemis Boulenger, 1896, Ann. Mag. Nat. Hist. (6), **17**, p. 403, pl. xvii, fig. 2: Chiradzulu, Nyasaland; Loveridge, 1929, U. S. Nat. Mus. Bull. No. 151, p. 114: Kizerui, Usambara Mountains, Tanganyika Territory: Ahl, 1930, Sitzber. Ges. Naturf Freunde Berlin, p. 91: Ipiana; Rungwe; Kilwa, etc., Tanganyika Territory.

? *Hyperolius multifasciatus* Ahl, 1931, Mitt. Zoöl. Mus. Berlin, **17**, p. 24: Rungwe, Tanganyika Territory.

? *Hyperolius acuticeps* Ahl, 1931, *loc. cit.* p. 29: Ukonde-Unyika, Tanganyika Territory.

Hyperolius ipianae Ahl, 1931, *loc. cit.* p. 43: Ipiana, Tanganyika Territory.

Hyperolius unicolor Ahl, 1931, *loc. cit.* p. 122: Ipiana, Tanganyika Territory.

51 (M. C. Z. 16826–36) Mwera, Zanzibar. 21. x. 29.
314 (M. C. Z. 16837–46) Mwaya, Lake Nyasa. 1. iii. 30.
1 (M. C. Z. 16847) Mwandemeres, Rungwe. 11. iii. 30.
3 (M. C. Z. 16848–50) Ujiji, Lake Tanganyika. 28. v. 30.

Affinities. As the species placed in the synonymy were based on single specimens, except *acuticeps* of which the author had two, I have been unable to examine the types and therefore my supposition as to their status is a tentative one. From the citations it will be noted that there are examples of *brachynemis* in the Berlin Museum from both Rungwe and Ipiana. Ipiana is ten miles from Mwaya and forty from Rungwe; both are in the region settled by Wakonde and Wanyika.

Habitat. The whole series are from domestic bananas. It may be thought that there is some mistake in listing the whole Mwaya series as taken on a single day; not only is there no mistake, but all were brought in between the hours of 3 and 6 p.m. as described in the introduction to these reports.

? Hyperolius sansibaricus (Pfeffer)

Rappia sansibarica Pfeffer, 1893 (1892), Jarhb. Hamburg Wiss. Anst. **10**, part 1, p. 97, pl. ii, fig. 4: Zanzibar.

3 (M. C. Z. 171148–50) Bagamoyo. 16. xi. 29.

Affinities. Unfortunately these three frogs are damaged with rust from their container and are identified with grave doubts. Two of them have irregular tubercles on the head as described for *sansibaricus* which Boulenger once suggested was a synonym of *cinctiventris* Cope. In life they were unlike any other *Hyperoli* with which I am acquainted.

Coloration in life. Above, bright rufous with dark brown markings. After chloroforming they changed to: Pale yellowish green minutely speckled with black, congregations of these spots forming dusky patches; thighs clearer, yolk-colored with narrow red (blood vessel) line showing through the skin, speckles just visible. Below, yellow tinged with pink in places, belly between fore and hind limbs satin-white. One of the others was drab-gray or putty-colored in life.

Measurements. These three males range from 26 to 28 mm.

Habitat. Taken on sedges in the swamp eight miles west of the town.

Hyperolius viridiflavus (Duméril & Bibron)

Euchnemis viridi-flavus Duméril & Bibron, 1841, Érpét. Gén., **8**, p. 528: Abyssinia (= Ethiopia).

The five types are in excellent preservation. Each has a little pouch in the centre of the throat but no gular disk, if the head is strained backwards there is no strong fold, if slightly forwards a fold appears though perhaps not strong. If considered a fold it keys to *viridiflavus* if not to *salinae.*

The fingers may be said to be half-webbed, actually the web extends to the last joint inner and outer aspects except that on the outer it extends as a narrow margin to the disk and on the 3rd finger it is somewhat less on the inner side so that the 3rd finger can hardly be called half-webbed being only a third-webbed; the tibio-tarsal articulation of the adpressed hind limb marks the eye. The skin is smooth above and below but slightly granular on the flanks posteriorly. The diameter of the orbit practically equals that of the snout, it is greater than the distance from the anterior border of the eye to the nostril.

Coloration in alcohol. Above, uniform gray except for a very few white specks which are practically absent from some of the series; the thighs are white except for a few fine specks and the trace of a narrow silver line.

Hyperolius symetricus (Mocquard)

Rappia symetrica Mocquard, 1902, Bull. Mus. Hist. Nat. Paris, **8**, p. 408: Athi River, Kenya Colony.

Hyperolius symetricus Loveridge, 1929, U. S. Nat. Mus. Bull. 151, p. 118: Nairobi; Wambugu; Mt. Kenya, Kenya Colony; Loveridge, 1930, Proc. Zoöl. Soc. London, p. 28: Key to species.

Hyperolius asper Ahl, 1931, Mitt. Zoöl. Mus. Berlin, **17**, p. 49: Nairobi, Kenya Colony.

In passing through Paris I availed myself of Mons. Angel's kindness and examined the holotype of this species which correctly responded to the key published in 1930 and represents the same species as the examples in the United States National Museum which were reported on in 1929. The following notes, confirmatory or additional to the original description, were made from the type.

It is a male with gular disk and fold across the chest; the snout is equal to the orbital diameter as stated, though on the right side the orbital diameter appears to only equal the distance from the nostril to the anterior border of the eye; the fingers are half-webbed, i.e. to the last articulation except the 2nd which is webbed right to the disk (or practically so) on the inner aspect, in this respect it differs from the type of *ferniquei*, the outer finger is half-webbed; the webbing on the toes is identical with that of *ferniquei*, the 1st is webbed to the disk, the 2nd and 3rd on their outer aspect to the last joint, on their inner to the disk, the 4th to the last joint on the inner side, to the disk on the outer, the 5th to the disk. The back is smooth except for a regular parallel series of dorso-lateral pimples or warts.

Coloration in alcohol. This specimen must have been very handsomely colored in life through now somewhat faded. The interorbital, sub-triangular marking is still distinct; a brown stripe from the nostril passes through the eye and widens into a large blotch extending nearly to midbody; the whole upper edge of the patch from the nostril is bordered by a relatively broad band of china-like whiteness; a similar line along the lip terminates above the fore limb, otherwise it gives the impression of the blotch being completely surrounded by white; another blotch on the flank is three-quarters surrounded by a white edge; there are similar white-edged blotches on the thigh, tibia and above the anus which continue and complete the pattern when the frog is at rest and thus assist in breaking up its outline. Below, white, the throat finely speckled with brown, a few brown speckles on the abdomen and lower sides.

Hyperolius striolatus Peters

Hyperolius striolatus Peters, 1882, Sitzber. Ges. Naturf. Freunde Berlin, p. 9: Taita, Kenya Colony.

Rappia ferniquei Mocquard, 1902, Bull. Mus. Hist. Nat. Paris, **8**, p. 407: Athi River, Kenya Colony. (Atchi *errore*).

Rappia marmorata Procter (*nec.* Rapp), 1920, Proc. Zoöl. Soc. London, p. 417.

Hyperolius marmoratus Loveridge, (part), 1929, U. S. Nat. Mus. Bull. No. 151, pp. 116–7: various localities in Kenya.

Hyperolius coeruleopunctatus Ahl, 1931, Mitt. Zoöl. Mus. Berlin, p. 76: Kibwezi and Nairobi, Kenya Colony.

Hyperolius udjidjiensis Ahl (part), 1931, *loc. cit.* p. 97: Kibwezi, Kenya Colony. (The Ujiji specimen may be distinct).

The Museum of Comparative Zoölogy has examples of this frog from Bissel, Nairobi and Naivasha in Kenya Colony. Whether any constant morphological characters will be found to distinguish the somewhat similar forms from the Central Lake Region (Ujiji, Lake Tanganyika; Kissenje, Lake Kivu; Bukoba, Lake Victoria, etc.) remains to be seen.

The Kenya frogs are certainly identical with *striolatus* as figured by Ahl (1931, Das Tierrich, **55**, pp. 312–3, fig. 187) and when the time comes for a revision of the genus, *striolatus* will certainly have to be recognized as distinct from *marmoratus* though possibly only as a color form. In 1920, the late Miss Procter, following Boulenger who considered *striolatus* a synonym of *marmoratus*, referred my Nairobi frogs to the latter species; tentatively and with reservations I followed this procedure in 1929 (*loc. cit.*) when dealing with the Smithsonian Expedition material: the color varieties numbered 2, 3 and 4 in that paper should be referred to *striolatus*.

The holotype of *ferniquei* was another of the frogs which I was able to examine when in Paris with interesting results. Most important of these was the discovery of my own error (1930, Proc. Zoöl. Soc. London, p. 25) in stating that the tympanum of this species was distinct, whereas it is hidden as in all other East African members of the genus. The error arose at the time I was stationed in Nairobi when a good friend sent me translations of certain descriptions which were not procurable in East Africa. In translating the description of *ferniquei* he wrote "distinct" instead of "indistinct," and I never had occasion to check this translation until recently.

The holotype of *ferniquei* is a male with a gular disk and a slight fold behind it. The diameter of the orbit is equal to the distance from the anterior border of the eye to the nostril, *not* to the end of the snout; the fingers are half-webbed, i.e. to the first joint, the outermost finger is half-webbed but not more; the toes are beautifully preserved and when seen from below the 1st is webbed to the disk (alternatively it might be said to be webbed halfway between the terminal joint and the

disk and continued to the latter as a narrow margin), the 2nd and 3rd to the disk on the inner side, to the last joint on the outer, the 4th to the last joint on the inner and to the disk on the outer, the 5th to the disk. The back is smooth though by careful search a slight granulation is apparently to be observed. When tested by my 1930 key to the species of *Hyperolius*, the type of *ferniquei* agrees with *marmoratus* if one considers that it has a strong fold across the chest, if no strong fold, then it runs down to *salinae*.

Its present color in alcohol is a slightly pinkish buff vermiculated with brown all over the upper surface, the vermiculations being formed of many juxtaposed fine dots; on the flanks these dots are separated and blacker. Below, white, the throat finely dotted all over, the dots coalescing to form two dark patches situated posterio-laterally. It is undoubtedly much faded.

Hyperolius callichromus Ahl

Hyperolius guttulatus Barbour & Loveridge (*nec.* Günther), 1930, in Strong, African Republic of Liberia, **2**, p. 794: Uvira, Lake Tanganyika, Belgian Congo.

Hyperolius callichromus Ahl, 1931, Mitt. Zoöl. Mus. Berlin, p. 99: Western bank of Rusizi River and Northwest shore of Lake Tanganyika, Belgian Congo.

21 (M. C. Z. 17151–60) Nyamkolo, Lake Tanganyika. 9. v. 30.
1 (M. C. Z. 17161) Ujiji, Lake Tanganyika. 28. v. 30.

Affinities. The coastal frogs (Dar es Salaam, Bagamoyo, etc.) referred to *callichromus* by Ahl are more probably referable to *puncticulatus* Pfeffer which occasionally produces mutants similar in dorsal pattern to *callichromus*; as far as my experience goes, however, such coastal frogs may be distinguished from *callichromus* of the Lake Region by their retention of a streak connecting the nostril and eye.

The frog from Uvira which is at the extreme north end of Lake Tanganyika just west of the mouth of the Rusizi River is undoubtedly conspecific with *callichromus* being an example in which the vertebral streak has broken up into a series of spots, similar individuals occur in the Nyamkolo series with which it also agrees in having large blotches or streaks on the tibia. On the other hand two cotypes of *callichromus* (M. C. Z. 17630–1) differ from the Uvira and Nyamkolo frogs in having the tibia finely speckled in place of one or more large blotches. The Ujiji frog combines both types for it possesses both large blotches and fine speckling.

Coloration in life. The whole series is irregularly spotted and streaked. The actual coloring has several times been figured under the name of *marmoratus* but the Central African frog appears to be of larger size than the Natal species.

Measurements. The largest frog, a female, measures 36 mm.

Breeding. Females from both Nyamkolo and Ujiji hold well-developed ova.

Diet. Beetles and a hemipteron.

Habitat. Found squatting on sedges growing from deep water. They are very conspicuous but also exhibit unusual activity for frogs of this genus. When approached they show a tendency to leap away before one is at all close; they then dive and either remain below the surface for some time, or swim away to a distance before coming to the surface.

Hyperolius rhodoscelis (Boulenger)

Rappia rhodoscelis Boulenger, 1901, Ann. Mus. Congo, (1) II, fasc. 1, p. 3, pl. ii, fig. 1: Pweto, Lake Mweru, Belgian Congo.

41 (M. C. Z. 17236–50) Nyamkolo, Lake Tanganyika. 9. v. 30.

Distribution. Formerly known only from the type locality which is thirty miles due west of Nyamkolo.

Affinities. Boulenger has pointed out that this species is nearly related to *H. marmoratus* and *H. argus;* it seems to be even nearer to *picturatus*, from which it differs in its blunter snout and larger size.

Variation. The interorbital space, said to be "*peu plus étroite*" than the upper eyelid is often as much as twice as broad. The throat is granular in males but *not* in the females.

Coloration in life. Adult. Above, rich green (or chrome yellow), a purplish brown line, composed of closely juxtaposed dots, commences at the nostril, passes through the eye, broadens just behind the eye and then diminishes along the flank to the thigh where it merges into an area of widely separated dots on the thigh; a narrow vitta of green (or yellow) on the upper surface of the thigh, anterior surface of the thigh vermilion (not blood red) as is also the posterior in the immediate vicinity of the knee, the vermilion coloring spreading on to the tibia; upper surface of the foot yellow (or orange) splashed with vermilion. Below, white on throat; cream on breast and belly; colorless on limbs; orange on soles of hands and feet.

Young. Above, a dusky, satiny brown composed of a multitude of fine specks; a light, dark-edged vertebral stripe commencing between the eyes, extends to the anus; it is flanked on either side by similar but

slightly broader, light lines commencing at the nostrils, passing through the eyes and along the flanks to terminate at the groin; a less well-defined line still lower on the flanks is apt to merge into the white of the belly; a splash of vermilion on the anterior surface of the thigh which is uniformly speckled with greyish brown above, on the tibia these dots tend to form longitudinal stripes; hands and feet yellowish.

During development the white lines of the young become yellowish, then yellow, and spread till they merge to form the uniform yellow (eventually green) back; the dark edging on the lower side of the uppermost lateral band broadens and deepens in color to form the side streak of the adult frog. The livery of the young appeared to me to be indistinguishable from that of young *puncticulatus* from the Uluguru Mountains. That they are the young of *rhodoscelis*, however, seems obvious despite a trifling difference in the amount of webbing. Both young and adult were taken in the same patch of sedges.

Measurements. Eight males range from 23 to 31 mm., average 27 mm.; twenty females range from 23 to 34 mm., average 29 mm. due to so many immature specimens; thirteen young range from 18 to 22 mm., average 22 mm. The gular disk of the male is apparent at 23 mm.

Breeding. While some females were bloated with eggs, others had evidently laid; some of the numerous young still showed tails when measuring 18 and 19 mm. from snout to anus, though others of the same dimensions had lost their tails.

Diet. Most stomach contents were too finely masticated for identification, the following, however, were recognisable: (1) large orthopteran, (2) caterpillar, (3) bug, weevil and skipjack beetle, (4) minute neuroptera, spiders.

Hyperolius picturatus Peters

Hyperolius picturatus Peters, 1875, Monatsb. Akad. Wiss. Berlin, p. 206, pl. ii, fig. 2: Boutry, Ashanti, Gold Coast.

3 (M. C. Z. 17251–3) Kampala, Uganda. vi. 30.

Distribution. This species has often been recorded from Uganda and is reported from Kenya Colony and Pemba Island. This last record of Boettger's to judge by his remarks and comparison with Tornier's figure 108 of plate ii, makes it practically certain that he had a specimen of *H. puncticulatus* (Pfeffer).

Variation. These frogs have been compared with specimens from the Gaboon (det. Boulenger) and Cameroon and appear to be specifically identical.

Measurements. The males measure 24 and 27 mm., the female 28 mm.

Hyperolius puncticulatus (Pfeffer)

Rappia puncticulata Pfeffer, 1893, Jahrb. Hamburg Wiss. Anst. **10**, p. 99, pl. ii, fig. 2: Zanzibar.

Rappia argus Procter (*nec.* Peters), 1920, Proc. Zoöl. Soc. London, p. 417: Morogoro and Dar es Salaam, Tanganyika Territory.

Hyperolius argus Barbour & Loveridge (*nec.* Peters), 1928, Mem. Mus. Comp. Zoöl., **50**, p. 222: Nyingwa and Vituri, Uluguru Mtns., Tanganyika Territory.

Hyperolius substriatus Ahl, 1931, Mitt. Zoöl. Mus. Berlin, **17**, p. 84: Amani, Dar es Salaam, Uhehe, Ukonde-Unyika, Ujiji, etc., Tanganyika Territory.

Hyperolius callichromus Ahl (part), 1931, *loc. cit.* p. 99: Bagamoyo, Dar es Salaam, etc., Tanganyika Territory.

1 (M. C. Z. 17162) Mwera, Zanzibar, 21. x. 29.
1 (M. C. Z. 17163) Mwaya, Lake Nyasa. 1. iii. 30.
3 (M. C. Z. 17164–6) Ilolo, Rungwe. iii. 30.

Distribution. The Zanzibar frog is a topotype. Having collected large series of this frog at Amani, Dar es Salaam, etc. on previous expeditions no particular attempt was made to get them on the present one. Ilolo is almost on the Unyika Plateau from which the British Museum has a series of these frogs. The distribution of this species appears to be dependent upon banana plantations and is little affected by altitude for they occur from the coast up to 7,500 feet.

Affinities. Parker (1931, Proc. Zoöl. Soc. London, p. 902) has recently shown that the specimens from the Uluguru Mountains referred by Barbour and myself to *argus,* are really variants of *puncticulatus.* The misidentification was due to the fact that our only comparative material (Nyika Plateau, det. Boulenger, and Morogoro, det. Procter) was also *puncticulatus* misidentified as *argus.* Whether the Ujiji cotype of *substriatus* Ahl is conspecific is questionable.

Coloration in life. In the field I noted that the Ilolo frogs were brought in with a series of *marginatus* Peters from which they were morphologically indistinguishable though undoubtedly not specifically identical; they were separated on the basis of the cantho-lateral band which is typical of *puncticulatus.*

Measurements. The largest frog, a female, measures 34 mm.

Hyperolius marginatus Peters

Hyperolius marginatus Peters, 1854, Sitzber. Akad. Wiss. Berlin, p. 627: Maçanga, Mozambique; 1882, Reise nach Mossamb., **3**, p. 165, pl. xxii, fig. 8.

Hyperolius pictus Ahl (part), 1931, Mitt. Zoöl. Mus. Berlin, **17**, p. 44: Ngosi Volcano Crater Lake; Uhehe; Iringa; Rungwe; Ukinga Mountains, Tanganyika Territory.

Hyperolius ngoriensis Ahl, 1931, *loc. cit.* p. 60: Ngosi Volcano Crater Lake, Tanganyika Territory.

Spawn and 38 (M. C. Z. 17174–84) Dabaga, Uzungwe Mtns. 1. i. 30.
1 (M. C. Z. 17276) Boma Ngombe, Uzungwe Mtns. 4. i. 30.
14 (M. C. Z. 17185–93) Kigogo, Uzungwe Mtns. 13–30. i. 30.
1 (M. C. Z. 17194) Lukungu, Uzungwe Mtns. 8. ii. 30.
2 (M. C. Z. 17195–6) Ihenye, Uzungwe Mtns. 8. ii. 30.
1 (M. C. Z. 17197) Mangoto, Ukinga Mtns. 10. ii. 30.
3 (M. C. Z. 17198–200) Madehani, Ukinga Mtns. 19–21. ii. 30.
122 (M. C. Z. 17201–225) Nyamwanga, Poroto Mtns. 17. iii. 30.
25 (M. C. Z. 17226–35) Ngosi Crater, Poroto Mtns. 18. iii. 30.
7 (M. C. Z. 17167–74) Ilolo, Rungwe District. 19–30. iii. 30.

Distribution. I have taken the liberty of correcting the misspellings of the type localities as given by Ahl, viz. Ngosi for "Ngori," Rungwe for "Rugwe," Unyika for "Nika."

I very much doubt if the paratypes of *pictus* from Nairobi, Bukoba and perhaps some of the other localities are specifically identical with those from the Ngosi Crater.

Native names. Kolamwilwe (Kihehe); *tufi* (Kikinga, probably not specific or generic).

Affinities. This species appears to be related to *concolor* Hallowell and *picturatus* Peters of West Africa; several of Bocage's Angolan species may be synonymous.

That the 227 frogs listed above are all one species there is not the slightest doubt; nor is there the least question of their specific identity with Ahl's *pictus* and *ngoriensis* which are figured on pages 302 and 324 of Das Tierrich, 1931, **55**, Amphibia Anura iii. Five of the variations are very well portrayed in fig. 176 (page 302) and were observed in the field where all the above material was provisionally listed and identified as one species.

It is possible, though improbable, that *marginatus* Peters is distinct for I have no topotypical material for comparison. The coloring of Peter's figure in Reise nach Mossambique is presumably hypothetical and incorrect though the pattern is accurately delineated. Moreover Ahl records the distribution of *marginatus* as "Mozambique bis Deutsch-Ostafrika," obviously by the latter he intended Tanganyika Territory.

It will be seen that the above series contains topotypes of all three of Ahl's "species" for *ngoriensis* is only a young *pictus* and the figure is in

complete agreement with juveniles from Ngosi Crater in the present series.

Coloration in life. The following notes were made on catching the first examples of this frog as it was recognised as a species never before encountered by me in Kenya Colony or Tanganyika Territory:

Dabaga. Color very variable, hardly two alike but in all green predominates above, yellow below and there is blood red on the hinder side of thighs and tibia. Above, olive, a yellow green streak from nostril over the eye nearly to the groin, two straight, greenish, dorso-lateral streaks within these lines which break up into yellow, black-edged, spots and streaks in the vicinity of the anus; fore and hind limbs olive, spotted with yellow green, blood red on the hinder sides of thigh and tibia. Below, bright chrome yellow.

Lukungu. A female whose back was dark sap-green. Below yellowish white.

Ihenye. Above uniform gamboge, a very irregular dark line as of diamond-shaped areas united by parallel lines from the nostril through the eye to the flank where it breaks up and disappears about midbody. When the hind limbs are in a position of rest it will be seen that the line is continued upon them (very broadly on the thigh which is hidden at rest) narrowly on the tibia and foot. The inside angles between the thigh and tibia, tibia and tarsus, and the top of the foot are blood red.

Mangoto. A female with the same coloring as the last but with more brown mottling and marbling on the hind limbs.

Kigogo. A frog with green stripes was placed in a vivarium with dead, brown grass, whereupon it turned uniformly olivaceous brown.

Nyamwanga. It was noted that the color pattern of the young shows great variability.

Measurements. A large ♀ (M. C. Z. 17189) measures 34 mm., but this is unusual from 26 to 29 mm. being a more usual size; several ♂♂ are 29 mm.

Breeding. At Dabaga spawn, of what was almost certainly this species, was collected on January 1st; the only other frogs found in the vicinity were males of *Rana ansorgii* and both sexes of *Arthroleptis minutus*.

At Kigogo, on January 30th, four frogs were found in, or on the edge of, two large puddles on the path. A very small male was embracing a big female, the latter deposited black and white eggs (each more or less enveloped in an independent gelatinous sphere, though the spheres were not detached), in the water dish of the vivarium on February 1st.

Diet. Hemipteron, beetles, ants, a wasp and a spider were found in stomachs of this species.

Enemies. A Nyamwanga frog had lost a hind leg just below the knee-joint which had healed up.

Habitat. The majority were taken in heavily grass-grown, swampy ground in valleys of the mountains; at Kigogo one was found squatting in a shrub; the Madehani series were taken beside a stream in an open valley; some of the Ngosi Crater series in wild bananas.

Hyperolius mariae Barbour & Loveridge

Hyperolius mariae Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 217, pl. iii, fig. 1: Derema, Usambara Mtns., Tanganyika Territory.
Hyperolius fuelleborni Ahl, 1931, Mitt. Zoöl. Mus. Berlin, **17**, p. 75: Langenburg (i.e. Manda) on Lake Nyasa; Rungwe etc., Tanganyika Territory.

7 (M. C. Z. 17254–60) Mwaya, Lake Nyasa. 1–8. iii. 30.

Native name. *Korfe* (Kinyakusa).

Affinities. It was no small surprise to find these frogs at Mwaya and it appears probable that with such a wide distribution the species will eventually be synonymised with some earlier form. There is no doubt in my mind as to the correct identification, they differ from *concolor* in the absence of pigmentation on the thighs. Males have a gular disk and females a strong gular fold and pouch in the middle of the fold. A cotype of *fuelleborni* has been compared with them and with the type of *mariae*.

Coloration in life. In the field two of these frogs were compared with the colored plate of *mariae* with which they closely agreed. There is, however, wide variation in the dorsal markings of the other five which range from minute stippling with black specks, through small black spots to one which possesses large blotches on the back.

Measurements. The larger ♂ measures 29 mm., the largest of five ♀♀ 30 mm.

Breeding. The largest females hold well-developed ova.

Habitat. Taken on sedges in a swamp as at Derema; the climate at Mwaya is much hotter, however.

? Hyperolius platyrhinus (Procter)

Rappia platyrhinus Procter, 1920, Proc. Zoöl. Soc. London, p. 416, text-fig. 3: Nairobi, Kenya Colony.

1 (M. C. Z. 17261) Shinyanga, Usukuma. 3. vi. 30.
1 (M. C. Z. 17262) Jinja, Uganda. 3. vii. 30.

Affinities. I am far from satisfied that these two frogs are specifically

identical with *platyrhinus* but the Shinyanga frog is certainly the same as a series of twenty-five frogs from Nyambita, Usukuma, due north of Shinyanga, which I referred to *platyrhinus* in 1925 (Proc. Zoöl. Soc. London, p. 785).

Measurements. These males measure 25 and 22 mm. respectively.

Coloration. The thighs of both are minutely speckled with black as are the backs.

Aestivating. The Shinyanga frog has extensive deposits of fat. It was found on the door of a safe standing on a verandah of a house out on a plain with no trees or shade within several hundred yards. The owner of the house said that it was on the safe when he left home a month before and was still there on his return on June 3rd at which time the weather was very hot.

Hyperolius granulatus (Boulenger)

Rappia granulata Boulenger, 1901, Ann. Mus. Congo, (1) ii, fasc. 1, p. 4, pl. ii, fig. 3: Pweto, Lake Mweru, Belgian Congo.

2 (M. C. Z. 17274–5) Nyamkolo, Lake Tanganyika. 9. v. 30.

Distribution. The type locality is thirty miles due west of Nyamkolo. There is an example of this frog from "Kinyamkolo" in the British Museum labelled *H. nasuta*. I have compared my specimens with a true *nasuta* from Ngola, Angola but that species has a much sharper snout.

Variation. Except with a lens, the granular nature of the skin is not noticeable in these formalin-preserved specimens.

Coloration in life. Rich green; unfortunately no notes were taken in the field as it was mistaken for a form of *microps*.

Measurements. Both are females and measure 19 and 21 mm.

Breeding. Both distended with ova.

Habitat. Taken among sedges.

Hyperolius parkeri sp. nov.

Hyperolius microps (part) Barbour & Loveridge (not of Günther), 1928, Mem. Mus. Comp. Zoöl., **50**, p. 225, and Loveridge, 1932, Proc. Biol. Soc. Washington, **45**, p. 63.

19 & eggs (M. C. Z. 17263–73) Bagamoyo. 16. xi. 29.

Type. Museum of Comparative Zoölogy, No. 13365. An adult ♀ from Mogogoni swamp, south of Dar es Salaam, Usaramo, Tanganyika Territory, collected by Arthur Loveridge, November 10, 1926.

Paratypes. Museum of Comparative Zoölogy, Nos. 13366–7 from Derema, Usambara Mountains, Tanganyika Territory, collected 30. xi. 26, and nineteen others from Bagamoyo as listed above.

Correction. The five frogs referred to *microps* Günther by Barbour and Loveridge in 1928 have subsequently proved (as a result of the capture of the Bagamoyo series comprised of both sexes) to represent two species, both of which occur at Dar es Salaam. A pair of these have become the types of *H. usaramoae* Loveridge (1932, Proc. Biol. Soc. Washington, **45**, p. 63) but the others, which at that time I still thought must represent *microps*, are not that species according to Parker. The frogs referred to as "*microps*" in that paper are, therefore, the types of *parkeri*, so named in appreciation of Mr. Parker's kindness in comparing the type (M. C. Z. 13365) with the type of *microps*.

Diagnosis. The type, having been compared with the type of *microps* Mr. Parker writes: "Your specimen 13,365 is twice as big as the type of *microps* with a longer, flatter snout, appreciably more web between the toes, and a different color pattern." Parker's statement that the Dar es Salaam frog is twice the size of *microps* reveals the fact that when Günther stated the length of *microps* to be ten lines, he must have used line in the metric sense and not in the more usual English definition as a twelfth of an inch. In 1928 I assumed the latter interpretation when stating that the type of *microps* was 21 mm. in length, apparently it is 10 mm.

H. parkeri differs from *usaramoae* precisely in the way that the latter is stated to differ from "*microps*" in the 1932 paper where one should substitute "*parkeri*" for "*microps*."

H. parkeri differs from *petersi* Ahl (only known to me from the description and figure) in the head being markedly longer than broad, the more acuminate snout, the upper jaw projecting beyond the lower and the more extensive webbing of the toes.

Males in the Bagamoyo series are distinguished from the females, not only by their granular gular disk but by the spines (probably only a breeding season development) on the soles of their feet. Such spines being absent in the females.

Coloration in life. Type ♀, gravid, numerous ova observable through the semi-transparent abdominal skin. Above, rich green, a silvery lateral line (disappears on preservation) bordered above and below by a series of deep black spots; the whole upper surface is speckled with minute black specks; limbs greenish yellow. Below, a faintly greenish shade tinged with blue on the throat.

In the Bagamoyo series the sexes exhibit a marked color difference.

The males are brown, or olive, exactly like the tints of the dead and dying sedges while the females were of a vividly fresh green hue like the living sedges. This green pigmentation is partly soluble, for the water in which dead *parkeri* are soaked for a few hours, takes on a green tinge. The throats of the frogs of either sex were scarcely blue, certainly not so pronouncedly so as in the type, but as the Bagamoyo series were collected six days later in the month and had already deposited ova, it may be that the blue disappears after oviposition. The light lateral line, marked above and below by parallel series of black dots, is present in both sexes.

The thighs of the males show some pigmentation and are not colorless like those of *usaramoae* males.

Measurements. Type ♀. Head and body to anus 23 mm., breadth of head 7.5 mm., length of head to angle of jaw 8 mm., length of snout from nostril 1.5 mm., length of snout from anterior border of orbit 4 mm., length of hind limb from anus 40 mm., length of fourth toe 5.5 mm.

The following data is based on the Bagamoyo series which, unfortunately, are stained by rust resulting from the corrosion of their container penetrating the wrappings during many months at the coast awaiting shipment. Five males range from 20 to 22 mm.; eleven females from 19 to 22 mm., average for both sexes being 20 mm.; three young measure 11, 12, and 19 mm. respectively.

Breeding. These frogs were calling from sedges in a swamp six miles out of town on the Ngerengere Road. The call was ringing and clear like a "pop-pop." The sedges were so sharp that it was almost impossible for my bare-legged assistants to get through them. Fortunately I was wearing rubber hip-boots and by advancing towards the boys with the broad length of my foot forward so as to trample down the sedges, I was able to drive the frogs, which were squatting on the sedges just a few inches above the water level, before me until they were caught by the boys. The water was just a foot deep.

The white eggs are laid on the sedges just above the water level; if the rains continue as they should do, then the eggs would be submerged in the course of a few days. The eggs, embedded in an oval patch of colorless jelly, numbered about sixty-nine and a hundred and ten respectively, these batches representing the laying of two frogs.

Kassina senegalensis (Duméril & Bibron)

Cystignathus senegalensis Duméril & Bibron, 1841, Érpét. Gén., **8**, p. 418: Lakes in the vicinity of Galam, Senegal.

1 (M. C. Z. 16775) Mainland opposite Kilindini. 29. x. 29.
1 (M. C. Z. 16776) Mwaya, Lake Nyasa. 1–8. iii. 30.
1 (M. C. Z. 16777) Mwandemeres, Rungwe. 11. iii. 30.
26 (M. C. Z. 16778–99) Ilolo, Rungwe. 15. iii. 30.
1 (M. C. Z. 16800) Ukerewe Id., Lake Victoria. 10. vi. 30.

Native name. *Dorya* (Kinyakusa).

Affinities. Hewitt (1926, Ann. S. African Mus., **20**, p. 488) has reinstated *K. wealii* Boulenger as a S. African species. The material listed above consists of twenty-two males and eight females and upholds his definition of *senegalensis.*

Measurements. The males range from 33 to 42 mm., average 38 mm.; the females range from 29 to 42 mm., with an average of 37 mm. though the breeding females (i.e. Ilolo series) average 40 mm.

Breeding. The Ilolo series were brought into camp by two small boys who had found them in a pool; evidently the males assemble first as they outnumbered the females by three to one. These females, as also the one from Mwaya, were distended with ova.

Habitat. Owing to its subterranean habits this frog is rarely encountered except when the rains break and they assemble to breed. The immature female from Kilindini was dug out of a male kingfisher's resting burrow in a sandy bank. The Ukerewe frog is also a young female and was found by Salimu beneath a log at the edge of a patch of dry bush.

BREVICIPITIDAE

Breviceps mossambicus Peters

Breviceps mossambicus Peters, 1855, Arch. Naturg., **21**, part 1, p. 58: Island of Mozambique and Sena.

8 (M. C. Z. 16430–7) Masiliwa, Turu. 10. xii. 29.
2 (M. C. Z. 16438–9) Mangasini, Usandawi. 14. xii. 29.
24 (M. C. Z. 16440–50) Ilolo, Rungwe. 15–30. iii. 30.

Distribution. Recorded from Iringa and Ipiana by Nieden.

Native name. *Tuvye* (Kinyakusa, but not specific).

Measurements. The largest, a Masiliwa frog, measures 52 mm., three of the Ilolo series are very small being 19, 22 and 26 mm. respectively.

Diet. Termites, both at Masiliwa and Ilolo.

Enemies. One was recovered from the stomach of a Boomslang (*Dispholidus typus*) at Masiliwa.

Habitat. The eight Masiliwa frogs were taken as they hopped away

from the woodland path along which I was cycling in the early morning after a night of heavy rain which ushered in the rainy season in this district. Most of the frogs were on patches of sodden leaves and none were seen after 9 a.m.

Probreviceps macrodactylus rungwensis Loveridge

Probreviceps macrodactylus rungwensis Loveridge, 1932, Bull. Mus. Comp. Zoöl., **72**, p. 387: Nkuka Forest, Rungwe Mtn., southwestern Tanganyika Territory.

4 (M. C. Z. 16451–4) Nkuka Forest, Rungwe Mtn. 25–30. iii. 30.

Native name. Tuvye (Kinyakusa but also applied to *Kassina, Phrynomerus* and *Breviceps*).

Breeding. Ova are moderately developed in the females.

Hoplophryne uluguruensis Barbour & Loveridge

Hoplophryne uluguruensis Barbour & Loveridge, 1928, Mem. Mus. Comp. Zoöl., **50**, p. 254, pl. ii, figs. 3 and 4: Nyange, Uluguru Mtns., Tanganyika Territory; Noble, 1929, Bull. Am. Mus. Nat. Hist., **58**, pp. 291–313.

In his paper on "The Adaptive Modifications of the Arboreal Tadpoles of the genus Hoplophryne," Noble makes several statements which are hardly in conformity with my published field notes which are the only source of information on the habits of this frog.

On page 292, the statement that *H. uluguruensis* "lays its eggs between the leaves of the wild banana" is a misconception which appears in one form or another at many places though rightly stated under "Conclusions" on page 330 as "between leaf and stalk of banana plants."

The rainwater is retained between stalk and leaf stalk, not "between the leaves of the wild bananas."

I cannot concur with the statement that "It is also possible that some of the tadpoles in the banana leaves may not reach the pockets of water but live exposed to air *as do the tadpoles in the bamboos.*" I am not aware that anyone has yet found the tadpoles alive in bamboos, it is certainly highly improbable that they are not submerged in the water retained by the internode. Though no mention was made of water being held by these internodes under the heading of *H. uluguruensis* in the 1928 paper, remarks had been made earlier on in this paper under *Nectophrynoides spp.* which were taken at the same spot. If one could visualize the heavy, driving rain storms of daily occur-

rence in October, and the continual mist-drenched condition of the rain forest at 7,500 feet where the bamboos were growing, it is difficult to conceive how any receptacle capable of retaining water was not so doing. The suggestion, or theory, that these tadpoles do not live in water is apparently based on an interpretation of their respiratory adaptations and pulmonary structure for on page 300, Noble suggests "that the larvae do not swim in the water caught between the banana leaves but remain on the edges of it or merely wriggle in damp crannies between the leaves. This conclusion is supported by other evidence to be discussed below." Apparently my statement that all these tadpoles were found swimming in the water is of no consequence and no reference is made to it. Even if it does nullify much attractive theorizing it seems advisable to repeat that, with the exception of tadpoles observed hatching and wriggling down the moist surface of the stem into the water, *in no single instance was a live tadpole found anywhere but in the water retained between stalk and leaf stalk* and tadpoles were found in about a score of the banana plants examined. It is difficult to imagine one of these tadpoles ever wriggling its way up the wet and slippery vertical stem of a banana plant within the outer leaves though one must admit that the adult frogs accomplish the feat. It is still less possible for the tadpoles to make their way from one pocket of water to another so that such statements as that on page 306 to the effect "that the larvae wriggle about in the crevices at the base of banana leaves and pick up with their toothless but powerful jaws what bits of animal or plant debris may occur there," appears to be somewhat idle speculation if intended to convey the impression, as is apparently the case, that these tadpoles are not wholly aquatic.

Phrynomerus bifasciatus (Smith)

Brachymerus bifasciatus A. Smith, 1849, Illus. Zoöl. S. Africa, **3**, pl. lxiii: Country to the east and northeast of Cape Colony.

24 (M. C. Z. 16410–25) Mwaya, Lake Nyasa. 1. iii. 30.
4 (M. C. Z. 16426–9) Mwandameres, Rungwe. 11. iii. 30.

Distribution. Nieden has recorded this species from Tanga, Bagamoyo, Dar es Salaam, Tukuyu and Ipiana near Mwaya.

Native name. Tuvye (Kinyakusa, but not specific).

Variation. There is no question that these frogs are typical *bifasciatus* and not *P. affinis* Boulenger from Lake Mweru. The digits and toes are long and slender and the terminal expansions larger than in

Kilosa specimens, much depends apparently on methods of preservation as to the degree of expansion.

Measurements. The largest, a Mwandemeres frog, measures 58 mm.

Diet. Ants.

Defence. I have previously drawn attention to the poisonous nature of the secretions of this frog, a further example came to my notice at Mwaya. One of my boys brought me a bag containing a mixed catch of frogs from bananas — *Hyperolius, Megalixalus, Leptopelis* and half-a-dozen *Phrynomerus.* I chloroformed the whole lot in the bag. An hour later I tipped the catch out on to a table and began picking out the various species. The *Phrynomerus* had exuded a considerable amount of intensely sticky dermal secretion which had gummed the smaller *Megalixalus* together. After separating these and dropping them into water I could not get the gummy mucous off my fingers by washing and so rubbed them in the dust — as a monkey would do — then by rubbing them together shed the mucous like so much gutta-percha. Shortly afterwards irritation set in on my finger tips entirely comparable to the irritation produced by stinging nettles and it actually appeared to spread *within* my arm up to the elbow of the right arm; perhaps I should add that the weather was very hot and my pores probably wide open.

Habitat. All were taken in domesticated banana plants.

EXPLANATION OF PLATES

PLATE 1

PLATE 1

Fig. 1. *Lygodactylus picturatus picturatus* (Peters), ♂ (M. C. Z. 30511) Dar es Salaam, Tanganyika Territory.

Fig. 2. *Lygodactylus picturatus* var., ♂ (M. C. Z. 30590) Kilindini, Mombasa Island, Kenya Colony.

Illustrating the two color phases occurring on the East African coast north of Tanga. Both are found on Mombasa Island though not together. Both enlarged about 1½ natural size.

Total length of each gecko 81 mm.

1 2

THE MERIDEN GRAVURE CO.

PLATE 2

PLATE 2

Fig. 1. *Agama agama turuensis* Loveridge, type ♂ (M. C. Z. 30686) Turu, Tanganyika Territory.

Fig. 2. *Agama agama dodomae* Loveridge, topotype ♂ (M. C. Z. 30739) Dodoma, Tanganyika Territory.

Fig. 3. *Agama agama ufipae* Loveridge, type ♂ (M. C. Z. 30741) Kipili, Ufipa, Tanganyika Territory.

Fig. 4. *Agama agama mwanzae* Loveridge, ♂ (M. C. Z. 30648) Mwanza, Tanganyika Territory.

All enlarged about 1½ natural size.

Showing the gular coloring characteristic of four races of rock-dwelling agamas. The throat is displayed by the courting male in an upward jerk. Females lack the gorgeous coloring of the males.

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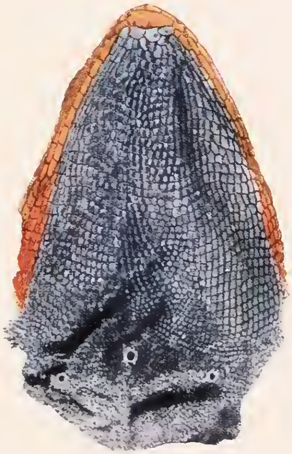

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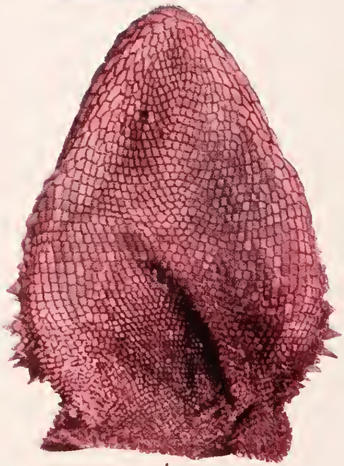

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THE MERIDEN GRAVURE CO.

PLATE 3

PLATE 3

Fig. 1. *Amphisbaena mpwapwaensis* Loveridge, type ♂ (M. C. Z. 30767) Mpwapwa, Ugogo.

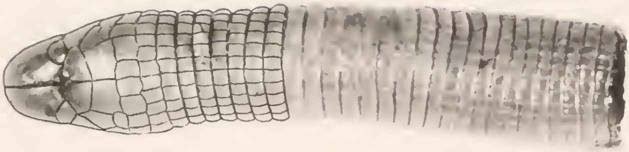
Fig. 2. *Zonurus ukingensis* Loveridge, type ♂ (M. C. Z. 30761) Tandala, Ukinga Mountains.

Fig. 3. *Chamaeleon laterispinis* Loveridge, type ♂ (M. C. Z. 31386) Kigogo, Uzungwe Mountains.

Fig. 4. *Chamaeleon incornutus* Loveridge, type ♂ (M. C. Z. 31350) Madehani, Ukinga Mountains.

Fig. 5. *Chamaeleon werneri dabagae* Loveridge, type ♀ (M. C. Z. 31344) Dabaga, Uzungwe Mountains.

All enlarged about 1 7/10 natural size.



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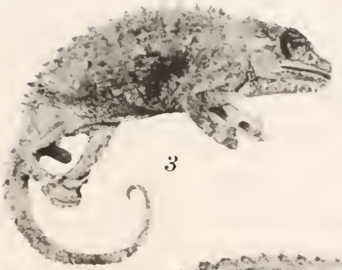

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THE HELIOTYPE CORP. BOSTON